DRAFT

Washington State Recovery Plan

for the

Sea Otter

Prepared by

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June 2000

In 1990, the Washington Fish and Wildlife Commission adopted procedures for listing and delisting species as endangered, threatened, or sensitive and for writing recovery and management plans for listed species (WAC 232-12-297), Appendix B). The procedures, developed by a group of citizens, interest groups, and state and federal agencies, require that recovery plans be developed for species listed as threatened or endangered. The sea otter is classified as an endangered species in Washington (WAC 232-12-014).

Recovery, as defined by the U.S. Fish and Wildlife Service, is "the process by which the decline of an endangered or threatened species is arrested or reversed, and threats to its survival are neutralized, so that its long-term survival in nature can be ensured."

This document summarizes the historic and current distribution and abundance of the sea otter in Washington, describes factors affecting the population and its habitat, and prescribes strategies to recover the species in Washington.

This is the Draft Washington State Recovery Plan for the Sea Otter. It is available for a 90-day public comment period. Please submit written comments on this report by **1 October 2000** to:

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This report should be cited as:

Richardson, S. and Allen, H. 2000. Draft Washington state recovery plan for the sea otter. Washington Department of Fish and Wildlife, Olympia, Washington. 67pp.

TABLE OF CONTENTS

LIST OF FIGURES vi

LIST OF TABLES vi

ACKNOWLEDGMENTS vii

EXECUTIVE SUMMARY viii

PART ONE: BACKGROUND 1

TAXONOMY 1

DESCRIPTION 1

GEOGRAPHIC DISTRIBUTION 2
North Pacific Ocean 2
Washington 3

NATURAL HISTORY 3
Ecological Importance 3
Reproduction 4
Mortality 4
Natural sources of mortality 4
Human-induced sources of mortality 5
Territoriality and Home Range 6
Dispersal and Seasonal Movements 7
Immigration and Emigration 8
Behavioral Characteristics 8
Food 9

HABITAT REQUIREMENTS 9

POPULATION STATUS 11
North Pacific 11
Washington 11
Original population 11
Reintroduced population 13
Current status 14

Distribution. 16
British Columbia 18

HABITAT STATUS 18
Ownership and Management 18
Environment 19

CONSERVATION STATUS 19
Legal Status 19
Washington 19
United States 20
International 21

MANAGEMENT ACTIVITIES 22
Reintroduction 22
Surveys 22
Research 22
Oil spill risk reduction and response 23
Fishery Interactions 23
Sea urchin 24
Dungeness crab 24
Razor clams 25
Abalones 26
Sea cucumber 26
Geoducks 27
Other bivalves 27
Fin fish 27

FACTORS AFFECTING CONTINUED EXISTENCE 28
Oil Spills 28
Sources 28
Vulnerability 28
Effects of oil on sea otters 29
Rescue and rehabilitation 29
Other Contaminants 30
Marine Biotoxins 31
Entanglement and Entrapment 31
Harvest 32
Habitat Loss 32
Genetic Diversity 33
Disturbance 33

Other Factors 34

CONCLUSIONS 34

PART TWO: RECOVERY 35

RECOVERY GOALS 35

RECOVERY OBJECTIVES 35
Rationale 35
Goals 35
Objective #1. 36
Objective #2. 37
Objective #3. 37

RECOVERY STRATEGIES AND TASKS 38
Monitor the Washington sea otter population. 38
Protect the sea otter population. 39
Protect habitats used by sea otters. 40
Enforce regulations designed to protect sea otters. 41
Establish information management and retrieval systems. 41
Develop public information and education programs. 41
Undertake investigations that will facilitate and enhance recovery efforts. 43
Coordinate and cooperate with public agencies, landowners, nongovernmental organizations, and funding sources. 45
Prepare for direct population management (intervention). 45

REFERENCES CITED 48

PERSONAL COMMUNICATIONS 60

IMPLEMENTATION SCHEDULE 61

Appendix A. 1977-1999 summer sea otter surveys for 3 segments of the Washington coast, and 1995-2000 winter locations (x) of a group of sea otters in the Strait of Juan de Fuca (Jameson et al. 1986; R. Jameson, USGS Biological Resources Division, unpublished data; Jeffries, pers. comm.).. 64

Appendix B. Washington Administrative Code 232-12-297. 65

LIST OF FIGURES

Figure 1. Current and 1800's distribution of the sea otter in Washington, including isolated sightings and 1969-70 release sites. 3
Figure 2. Nineteenth-century range of the sea otter in Washington, as illustrated by Scheffer (1940). Map reproduced with permission from *Pacific Northwest Quarterly*. . . . 12
Figure 3. High counts of Washington sea otters, 1977-1999, from surveys and observations by USFWS/USGS (Jameson et al. 1986; R. Jameson, USGS Biological Resources Division, unpublished data), WDFW and others (summarized in Bowlby et a. 1988, and S. Jeffries, WDFW, unpublished data). 1989-99 surveys conducted jointly by USFWS/USGS-WDFW. Both independent otters and pups are included. 15
Figure 4. Changes in distribution of Washington sea otter population, 1977-2000 and 1999-2000 concentrations of sea otters along the Washington coast (R. Jameson 1998b; R. Jameson and S. Jeffries, pers. comms.). 16

LIST OF TABLES

Table 1. Weights and lengths of adult sea otters from three populations. 2
Table 2. Prey animals documented in the diet of Washington sea otters. Items are included regardless of relative abundance or scarcity. Unidentified prey are not presented, though they are reported in all studies. Dashed lines separate major taxonomic groups. 10
Table 3. 1977-1988 sea otter counts in Washington. Both independent otters and pups are included 13
Table 4. Number and density of sea otters (number of otters per km of coastline) for three segments of the Washington coast surveyed 1997-99 (Jameson and Jeffries 1999).15
Table 5. Number and density of sea otters (number of otters per kilometer) for three segments of the Washington coast surveyed 1997-99 (Jameson and Jeffries 1999).17

ACKNOWLEDGMENTS

The following people are gratefully acknowledged for their help during the development of the *Draft Washington State Recovery Plan for the Sea Otter*.

Ron Jameson, Steve Jeffries, Ed Bowlby, and Barry Troutman are acknowledged for their contributions to building the database of information on the reintroduced sea otter population in Washington through monitoring and research. Ron Jameson has monitored the Washington population of sea otters since 1977 and is conducting long term research on the population demographics, diet, behavior and habitat use of the Washington sea otter population. He generously shared unpublished data and views on sea otter research and management. Steve Jeffries is thanked for the years of sea otter counts recorded during aerial surveys for other marine mammals on the Washington coast. He and Barry Troutman are thanked for critical reviews of early drafts of the recovery plan and many discussions regarding sea otter biology, threats, and management in Washington. Their integral involvement was essential to the completion of a thorough and accurate report.

Carl Benz provided useful information on southern sea otter recovery planning and Washington sea otter stock status. Steve Joner discussed the impact of sea otters on urchin and other fisheries. Other useful input on fisheries came from Alex Bradbury on sea urchins, Paul LaRiviere on Dungeness crab, Ray Buckley on fish in kelp mats, and Lee Hoines on fisheries statistics. Ronald Torrance and Mark Bruskiewicz explained tideland ownership. Diane Mitchell located both readily-accessible and obscure references with equal ease and provided them promptly and cheerfully. Darrell Pruett is thanked for the preparation of maps.

The following sea otter co-managers and experts are thanked for their participation on the on the Washington sea otter recovery planning group, which guided the document through its final stages of completion: Bobbi Barrera, Ed Bowlby, Patti Happe, Ron Jameson, Steve Jeffries, Steve Joner, Sarah LaMarr, Lisa Nordone, Trevin Taylor, Barry Troutman, and Glenn VanBlaricom.

We appreciate the critical reviews and helpful comments on earlier drafts of the plan by Morris Barker, Bobbi Barrera, Ed Bowlby, Alex Bradbury, Dave Hays, Ron Jameson, Steve Jeffries, Shawn Larson, Sally Nickelson, Derek Stinson, Barry Troutman, and Glenn VanBlaricom.

EXECUTIVE SUMMARY

Sea otters thrived off the coast of Washington for thousands of years before they were extirpated by an intensive harvest for their valuable pelts. From about 1911 to 1969, sea otters were absent from the state, but in 1969 and 1970, 59 otters were reintroduced to the coast from Amchitka Island, Alaska. After a decade of questionable status, the Washington sea otter population began to increase steadily. From 1989 to 1999, the population grew at an average annual rate of about 11%. The most recent survey, in July 1999, found 605 individuals.

The recent sea otter range in Washington has extended from Destruction Island to Neah Bay, with concentrations in the vicinities of Destruction Island, Cape Johnson, Sand Point, Cape Alava, and Makah Bay. The current distribution differs from the pre-exploitation range, which extended south to the Columbia River with a major concentration off Point Grenville. Some authorities consider further expansion of Washington's sea otter population unlikely, while others consider it inevitable. It is not possible to predict whether the population will continue to grow and spread and, if so, at what rate and in which direction.

Sea otters feed primarily on benthic invertebrates, consuming many pounds of prey each day to meet their high metabolic needs. They consume shellfish species—urchins, abalones, clams, crabs—important to commercial, recreational, and tribal fisheries, yet through their predation on sea urchins, they may, in some circumstances, indirectly enhance the growth of kelp and kelp-associated communities. Sea otters are vulnerable to oil spills and may eventually be harvested by Indian tribes. These issues and others, combined with the species' popular appeal, will complicate management and recovery of sea otters in Washington, as they have in Alaska and California.

The goals of the sea otter recovery plan are: 1) to outline strategies that will assure a self-sustaining sea otter population in Washington through the foreseeable future, and 2) to manage the Washington sea otter stock in a manner consistent with the federal Marine Mammal Protection Act, state and federal laws, and court rulings.

The sea otter will be considered for downlisting to State Threatened status when the following three conditions are met: 1) a population of at least 500 sea otters has existed in Washington for at least 5 consecutive years; 2) the Washington sea otter population is distributed such that a single catastrophic event, such as a major oil spill, would be unlikely to cause its extirpation; and 3) management plans or agreements by the state's sea otter co-managers are in place that provide for the continued viability of the sea otter in Washington. Downlisting to State Sensitive status will be considered when the population reaches 1,850 otters and criteria 2 and 3 above are met.

PART ONE: BACKGROUND

TAXONOMY

The sea otter (scientific name, *Enhydra lutris*; Makah name, *ti'tcak*; Quinault name, *kakwa 'lakeh*) is a member of the order Carnivora, the family Mustelidae, and the subfamily Lutrinae. The monotypic genus *Enhydra* evolved in the North Pacific about 1 to 3 million years ago, and has remained confined to this range since then (Riedman and Estes 1990). The species was described by Linnaeus in 1758 from Georg W. Steller's 1751 account; no type specimen exists (Wilson et al. 1991).

Subspecific distinctions within *Enhydra lutris* have received considerable attention (reviews in Riedman and Estes 1990, Anderson et al. 1996), with three subspecies currently recognized based on morphometric work by Wilson et al. (1991). *E. l. lutris* (Asian sea otter) occurs from the Kuril Islands to the Kamchatka Peninsula and the Commander Islands, *E. l. kenyoni* (Alaskan or northern sea otter) ranges from the Aleutian Islands to Washington, and *E. l. nereis* (California or southern sea otter) is found in California. Prior to its extirpation, the original Washington population may have been intermediate between *E. l. nereis* and *E. l. kenyoni*, but more closely allied with the latter (Wilson et al. 1991).

Variation in mitochondrial-DNA sequences suggests *E. l. nereis* may be the most genetically-distinct population, although sea otters rangewide apparently have experienced no major phylogenetic breaks or long-term barriers to gene flow (Cronin et al. 1996).

DESCRIPTION

Sea otters are among the largest members of the family Mustelidae, but are the smallest marine mammals in the North Pacific (Riedman and Estes 1990). In Washington, adult males average 39 kg (85.8 lb) in weight and 141 cm (55.5 in) in length (R. Jameson, unpublished data) (Table 1). Washington males may tend to be larger than adult males in long-established populations and roughly equivalent in size to adult males in sparse populations (Table 1). Adult females in Washington average 24 kg (52.8 lb) in weight and 127 cm (50 in) in length (R. Jameson, unpublished data), which is similar to females from other areas. Newborn pups weigh about 2 kg (4.4 lb) and measure 50 to 60 cm (20 to 24 in) in length (Riedman and Estes 1990).

Table 1. Weights and lengths of adult sea otters from three populations.

	Weight (kg)						Length (cm)					
	Male			Female			Male			Female		
	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n
Amchitka Island, Alaska[a]	28.3	7.93	79	21.1	6.49	254	143.0	4.3	79	125.2	4.73	254
Alaskan sparse populations[a]	39.5	10.12	5	25.2	13.0	4	140.8	0.5	5	129.8	6.3	4
Washington[b]	39.0	3.73	13	24.0	2.36	37	141.0	4.56	12	127.0	3.57	39

[a] Data from Kenyon (1969).
[b] Unpublished data from R. Jameson, USGS Biological Resources Division, Corvallis, Oregon

The sea otter pelage color ranges from dark brown to reddish brown, with older animals displaying paler fur around the head, neck, and shoulders (Estes 1980). Sea otters have no blubber layer; their thermoregulation is a function of a high metabolic rate and thick fur (up to 650,000 hairs per square inch) that entraps insulating air (Kenyon 1969). Otters have poor vision above water and fair or good vision below (Estes 1980). Their tactile sense (particularly in paws and whiskers) is well developed (Kenyon 1969, Estes 1980), and the senses of smell and hearing are thought to be good (Kenyon 1969, Riedman and Estes 1990).

River otters (*Lutra canadensis*) are frequently found along Washington's shorelines and observers sometimes misidentify them as sea otters. A few behavioral traits may help distinguish the two species (Kenyon 1969:11):

- A sea otter usually swims belly up, floating high on the water and holding its forepaws on its chest while paddling with its hind flippers; a river otter usually swims belly down, with its back nearly submerged;
- A sea otter is clumsy on land and is usually seen in the water; a river otter is agile on land and is often seen ashore;
- A sea otter always eats while floating on its back; a river otter usually eats on land.

GEOGRAPHIC DISTRIBUTION

North Pacific Ocean

Sea otters are found in nearshore marine waters along the coasts of California, Washington, British Columbia, and Alaska. Their range extends westward to the Commander Islands, Kamchatka Peninsula, the Kuril Islands, and northern Japan.

Washington

Sea otters occur along the Washington coast from Destruction Island to Pillar Point and have rarely dispersed far from their core range (Fig.1). While systematic surveys have not been conducted in the inland waters of Washington, a few isolated sightings have been confirmed in recent years in the eastern Strait of Juan de Fuca, the San Juan Islands, and within Puget Sound near Olympia (Fig. 1). Professional marine mammal biologists verified a single sea otter observed near Cattle Point, San Juan Island in October 1996 (J. E. Zamon, letter dated 11 November 1996 to G. VanBlaricom) and two sea otters were seen in southern Puget Sound between 1996 and March 1998 (J. Calambokidas, pers. comm., 1998). Beyond the southern extent of the core Washington range, two sea otters were sighted 16 km off Grays Harbor on 12 December 1999 (D. O'Hagan, pers. comm.).

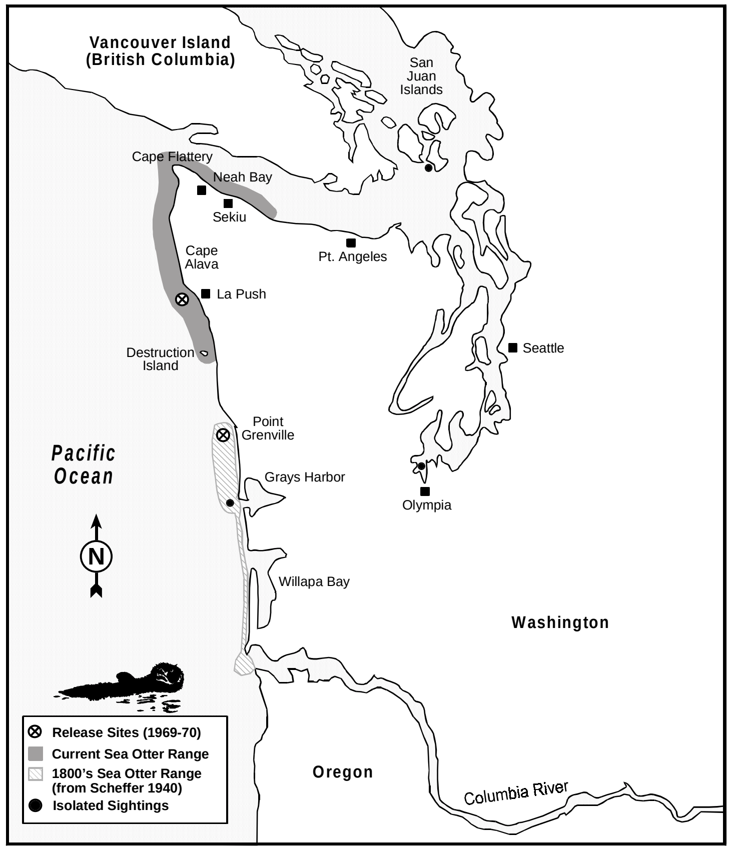

Figure 1. Current and 1800's distribution of the sea otter in Washington, including isolated sightings and 1969-70 release sites.

NATURAL HISTORY

Ecological Importance

The sea otter's fundamental role in structuring nearshore communities was described 25 years ago, when Estes and Palmisano (1974:1060) stated that along the Pacific coast of North America, "the sea otter is an evolutionary component essential to the integrity and stability of the [nearshore marine] ecosystem." They hypothesized that sea otters reduce sea urchin populations, thereby releasing kelp beds from grazing pressure and promoting the growth of kelp-associated communities. This paradigm appears broadly applicable in heir range extends westward to the Commander Islands, Kamchatka Peninsula, the Kuril Alaska (Estes and Duggins 1995) and has drawn widespread acceptance. However, some researchers (notably, Foster and Schiel 1988) have questioned its broad application, particularly in California.

Reproduction

Male sea otters apparently reach sexual maturity around age 5 or 6 years, but probably do not become territorial or reproductively successful for 2 or 3 subsequent years (Riedman and Estes 1990). Most female sea otters are sexually mature at age 4 or 5 years (Kenyon 1969, Jameson and Johnson 1993). Breeding activity can occur at any time of year, but coitus peaks in late autumn. In Washington, newborn pups have been observed during almost every month, but nearly half are born in March or April (Jameson 1997a). Females normally give birth to a single pup. Litters larger than one are rare, and when they occur, neither pup is likely to survive (Jameson and Bodkin 1986). Pups remain dependent upon their mothers for about 6 months (Jameson and Johnson 1993). A complete reproductive cycle typically requires 1 year.

Mortality

Longevity in sea otters is estimated to be 15 to 20 years for females and 10 to 15 years for males (Riedman and Estes 1990). R. Jameson (pers. comm.) obtained age data for two tagged adult female sea otters recovered in Washington; one lived to age 11, the other to age 13 (ages based on cementum annuli at the time of capture). Most information on sea otter mortality has been collected in Alaska and California, where carcasses have been accessible. Little data has been collected in Washington due to the remoteness of the Washington sea otter range; few carcasses are found in fresh enough condition to evaluate the causes of mortality.

Natural sources of mortality. Predation generally is not thought to be a significant source of mortality for sea otters, but it can be important in some areas. Orcas (*Orcinus orca*), white sharks (*Carcharodon carcharias*), bald eagles (*Haliaeetus leucocephalus*), coyotes (*Canis latrans*), and brown bears (*Ursus arctos*) each have been documented as sea otter predators (Riedman and Estes 1990).

Orca predation seems to have caused a sudden, precipitous sea otter population decline in the Aleutian Islands (Estes et al. 1998, Hatfield et al. 1998). Orcas have chased and consumed sea otters off Vancouver Island (L. Kayra, pers. comm. cited in Watson 1993), although otters do not appear to constitute a major orca prey item there (Watson 1993). Orcas have also caused sea otters in Prince William Sound to scatter and remain attentive (Beckel 1980). Otter-orca interactions are variable, however. The two species often have been observed coexisting peaceably in Alaska (Kenyon 1969), Washington (B. Troutman, R. Jameson, pers. comms.) and California (R. Jameson, pers. comm.). In California, Jameson observed increased alertness, but no movement on the part of a group of otters when orcas swam within few meters; and no apparent reaction by sea otters when orcas were observed in the general vicinity of the otters in Washington (Jameson, pers. comm.).

White sharks regularly inflict lethal wounds upon sea otters in California. At least 8% of 2013 southern sea otter carcasses inspected between 1968 and 1992 showed evidence of shark wounding (Ames et al. 1997). White sharks may also contribute to mortality in Washington. In 1975, a white shark tooth was found embedded in an otter carcass recovered at Cape Alava (Keyes 1975, cited in Bowlby et al. 1988).

Bald eagles have taken live sea otter pups in Alaska (Sherrod et al. 1975, Gelatt 1996). Gelatt (1996) estimated that bald eagles were responsible for up to 16% of the sea otter pup loss during the peak pupping period at Amchitka Island. The pups appeared to be vulnerable to eagles when they were less than three weeks of age, or less than a weight of about 2.7 kg. Remains of adult otters that have been found in eagle nests are thought to have been taken as carrion. Bald eagles are found within the Washington sea otter range, but no eagle predation on otters has been documented. Eagles are known to scavenge sea otter carcasses in Washington (R. Jameson, pers. comm.).

Heavy internal parasite loads are apparently a natural phenomenon in sea otters, although few links to mortality have been positively established. Spiny-headed worms (acanthocephalans) of the genus *Polymorphus* have been linked to peritonitis, especially in pups and juveniles (Thomas and Cole 1996). Jellison and Neiland (1965, cited in Kenyon 1969) listed parasites of sea otters.

Disease does not seem to be a significant source of mortality in sea otters (Kenyon 1969, Riedman and Estes 1990). A herpes-like virus caused oral lesions in Alaskan sea otters, but the virus was considered of “minimal health significance” (Harris et al. 1990:368). Herpes-like lesions have also been observed in sea otters captured in Washington (R. Jameson, pers. comm.). Protozoal encephalitis and coccidioidomycosis, as well as bacterial diseases, occur in California sea otters (Thomas and Cole 1996).

Thomas and Cole (1996) found 10% of the southern sea otters they examined to be emaciated without specific cause. Severe weather (strong winter storms, for example) and periodic climatic events such as El Niño can disrupt foraging behavior or food availability. Under these circumstances, sea otters may find it difficult to meet their high metabolic needs, leading to malnutrition or starvation. Serious tooth wear in older otters may also contribute to mortality (Riedman and Estes 1990).

Human-induced sources of mortality. Oil spills are the greatest anthropogenic threat to sea otter populations, and can impact sea otters in at least three ways. with at least three major impacts possible (Geraci and Williams 1990, Bonnell et al. 1996). First, oiled otter fur loses its insulative property; because otters have no blubber layer, they rapidly become hypothermic when oiled. Second, oil can be ingested while grooming, leading to gastrointestinal disorders, other ailments, and death. Third, volatile components of oil that are inhaled by sea otters can cause lung damage.

Estimates of sea otter mortality following the *Exxon Valdez* spill in Prince William Sound ranged from 2,650 (Garrott et al. 1993) to 3,905 (DeGange et al. 1994). Computer simulations suggested that even relatively small oil spills, "can cause a major and perhaps irrecoverable impact on the [southern] sea otter population" (Bonnell et al. 1996). Otter-impact simulations have not been prepared for potential oil spills in Washington. The use of oil spill trajectory models in assessing risk to sea otter populations has been useful in areas such as California and Alaska where the sea otter range is extensive and the oceanographic processes are complex. In Washington, however, the limited expanse of the sea otter range, coupled with well-defined nearshore current patterns, presents a situation where any spill into nearshore waters (within 10 miles of the coast) could potentially affect the entire range currently occupied by sea otters (B. Troutman, pers. comm.).

Drowning in gill and trammel nets caused the deaths of significant numbers of sea otters in California from the mid-1970's to the early 1980's (Wendell et al. 1985). Small numbers of sea otters are taken in set nets in Washington (e.g., Kajimura 1990, Gearin et al. 1996).

Sea otters are believed vulnerable to becoming trapped in crab pots (Newby 1975) and other fishing devices (Riedman and Estes 1990). While no entrapment has been documented in Washington to date, one otter was recovered from a king crab pot in Alaska (Newby 1975). Sea otters are sometimes victims of shooting; the last known gunshot mortality in Washington occurred in 1969 (Kenyon 1970). Boat collisions and capture activities also can contribute to sea otter mortality (Riedman and Estes 1990).

Further discussion of human-induced mortality can be found under "Factors Affecting Continued Existence" (p. 28).

Territoriality and Home Range

Sea otters are weakly territorial (Kenyon 1969); fighting and aggression are rare (Loughlin 1980). Only adult male sea otters establish territories, which are essentially exclusive foraging areas. Boundaries are maintained through "pronounced displays of splashing and grooming" (Riedman and Estes 1990:62).

Groups of male and female sea otters generally rest separately, with female areas found near the center of a population's range and male areas at the periphery. Female areas tend to be in areas protected from weather and strong seas, while male areas tend to be in more exposed situations. During the summer and fall, adult males are found within female areas and are often associated with rafts of females. Juvenile males and non-territorial males remain with male groups or wander throughout female areas. The location of male rafts can shift dramatically between seasons (Jameson 1989).

Compared to males, adult females are generally sedentary, but they may range widely during the breeding season. Their annual home ranges can occupy up to 80 ha and extend along 16 km of coastline (Kenyon 1969, Loughlin 1980). While they have smaller annual or lifetime home ranges than males, female home ranges are about 1.5-2 times larger than resident adult males during the breeding season (Riedman and Estes 1990). Adult territorial males may use two distinct territories—one in a female area and another in a male area—connected by a travel corridor (Ribic 1982, Jameson 1989). Jameson (1989) monitored home range sizes and movements of 19 male sea otters over a 6-year period in California. He found that territorial adult males occupied a mean home range of 40.3 ha in the summer-fall period (when home range size was considered equal to territory size); and mean coastline length was 1.1 km. The winter-spring mean home range size of territorial adult males that remained in female areas was 78.0 ha, with a mean coastline length of 2.16 km (Jameson 1989).

Dispersal and Seasonal Movements

In most areas, "otters tend to maintain an established home range until the effects of a dense population force movement" (Kenyon 1969:195). Males tend to disperse more readily than females, so they are typically the first to discover new regions with adequate food resources. Groups of male otters travel many miles when exploring, and will reside in new areas for extended periods if they find sufficient prey. After males establish a presence in a suitable area, females arrive and become resident. When population density reaches a threshold in occupied areas, male otters again begin to disperse. The sea otter range expansion in Washington appears to have progressed in this manner.

Sea otters sometimes shift distribution seasonally (Riedman and Estes 1990, Watson 1993), presumably to avoid exposure to winter storm waves and currents. This behavior was noted in Washington during the mid 1980's, when otters moved between Cape Johnson in the summer and Cape Alava in the winter (Bowlby et al. 1988). In 1995, a group of more than 100 sea otters began to enter the western Strait of Juan de Fuca near Neah Bay (Jameson 1995b). Animals have returned every winter since (R. Jameson, pers. comm.), and in 2000, came into the Strait of Juan de Fuca to just west of Pillar Point (S. Jeffries, pers. comm., Fig. 1).

Immigration and Emigration

Sea otters are capable of emigrating long distances from core populations. Wandering otters can settle permanently if they encounter "ideal" habitat conditions as they travel (Kenyon 1969). In some cases, small colonies can form as wanderers congregate at suitable sites.

To date, no otters are known to have immigrated from elsewhere to join the reintroduced Washington population. If Vancouver Island's growing population expands southward, or Washington's population continues to grow, interchange could occur. The deep, open water of the Strait of Juan de Fuca might function as a barrier to movement, although otters have overcome deep-water barriers to colonize various Aleutian islands (Kenyon 1969).

Behavioral Characteristics

Sea otters spend most of their time either foraging, resting, or grooming. They often forage actively around dawn and dusk, and sometimes forage at night. To meet their metabolic needs, sea otters must consume food equivalent to 20 to 25% of their own body weight each day (Kenyon 1969; Costa and Kooyman 1984, cited in Doroff and Bodkin 1994). Generally, they spend one-quarter to one-third of their time foraging and feeding (Riedman and Estes 1990). Foraging effort may be higher if resources are locally scarce (Estes et al. 1986:633), and lower if prey is plentiful (Garshelis et al. 1986, Bowlby et al. 1987). Specific foraging behaviors depend on time of day, time of year, environmental conditions, local prey species, and prey preferences of individual otters.

To obtain food, sea otters dive to the benthos, collect prey, then carry it to the surface for consumption. They may also carry a rock or another hard object, on which to break shells. Sea otters typically remain under water for 60 to 90 seconds while finding and procuring a prey item. They are tactile foragers, able to feel or dig for prey where the water is turbid or the substrate is soft. Sea otters typically dive less than 30 m for food (Kenyon 1969, Riedman and Estes 1990), but one otter in Alaska was recovered from a king crab pot in 100 m of water (Newby 1975).

Sea otters tend to rest during the middle of the day (Riedman and Estes 1990). Where populations are below carrying capacity, half to two-thirds of a sea otter's time might be spent resting (Estes et al. 1982, 1986; Garshelis et al. 1986; Bowlby et al. 1987). Where populations are at equilibrium density (and prey, therefore, less abundant), increased foraging time displaces resting and grooming time (Estes et al. 1982).

Sea otters are meticulous in cleaning their fur. Soiled pelage does not entrap air efficiently, which lowers an otter's ability to keep warm. Ordinarily, sea otters spend up to 20% of their time grooming (Riedman and Estes 1990).

Food

Shellfish dominate the sea otter diet. Two studies of the diets of sea otters in Washington have been conducted by observing foraging otters (Bowlby et al. 1988, Jameson 1995c); and one study of foraging behavior is ongoing (Jameson, pers. comm., unpublished data 1994-1998). Sea otters were observed eating sea urchins, various clams, crabs, octopuses, chitons, and sea cucumbers (Table 2). Fish constitute an important part of the diet of otters in Alaska, where otter populations have been established for long periods (Kenyon 1969, Riedman and Estes 1990). However, in recently occupied areas, sea otters feed primarily on sea urchins, various crustacean, and molluscs; fish are rarely consumed (Estes et al. 1982, Riedman and Estes 1990). Sea otter food habits in newly reoccupied areas are dramatically different from areas where they have been established for some time (R. Jameson, pers. comm.). In general, when sea otters reoccupy an area, they tend to exhaust one type of food before switching to another (Calkins 1972, Antonelis et al. 1981); whereas, in areas where otters have been established for some time, they tend to have a more diverse diet. Jameson (pers. comm) is finding this to be true with sea otter food habits observed in Washington.

HABITAT REQUIREMENTS

Sea otters live seaward of the high tide line almost exclusively. They occasionally haul out on offshore rocks and islands and less often on mainland beaches. This habitat-use pattern places sea otters primarily in areas defined as tidelands and bedlands. Tidelands include shores of tidal waters between mean high water and extreme low water, while bedlands are below the extreme low tide mark (Washington Administrative Code 332-30-106).

Sea otters use a variety of shallow coastal habitats. Their classic association is with rocky substrates supporting kelp beds, but they also frequent (at lower densities) soft-sediment areas where kelp is absent (Riedman and Estes 1990, DeMaster et al. 1996). In general, they remain in nearshore waters (seldom more than 1-2 km from shore) up to 20 fathoms in depth. They may favor topographically complex substrates in preference to relatively featureless bottoms (Riedman and Estes 1990).

Sea otters seem to prefer areas with surface kelp canopies, although this is not an essential habitat requirement. In some areas, they may rest in open water areas lacking the canopy-forming kelps. However, the kelp canopy is an important habitat component, used for foraging and resting (Riedman and Estes 1990).

Table 2. Prey animals documented in the diet of Washington sea otters. Items are included regardless of relative abundance or scarcity. Unidentified prey are not presented, though they are reported in all studies. Dashed lines separate major taxonomic groups.

Common name	CA[1]	CJ	SP	DP	OC1	OC2	TA	CF1	CF2	CF3	CF4
Worm species					●	●					
Peanut worm						●					
Barnacle						●					
Dungeness crab						●					
Red crab						●					
Kelp crab		●				●				●	●
Cancer crab										●	●
Rock crab											●
Crab species	●	●	●		●	●		●	●		
Crustacean species						●	●	●		●	●
Egg mass										●	●
Turban snail						●					
Snail species					●					●	
Bent-nosed clam						●					
California mussel						●					
Mussel species						●	●			●	●
Littleneck clam		●		●		●	●			●	●
Butter clam						●	●			●	●
Razor clam						●					
Gaper clam						●		●			
Clam species	●	●		●		●	●	●		●	●
Bivalve species					●			●			
Gumboot chiton	●	●			●	●				●	●
Chiton							●			●	●
Octopus	●	●	●	●	●	●	●	●		●	●
Red sea urchin		●	●			●	●	●	●	●	●
Purple sea urchin	●		●								●
Sea urchin species		●	●		●						
Many-rayed star						●					
Sea star species					●	●					
Sea star species						●					
Sea cucumber		●			●	●			●	●	●

[1] Observations represented in the table:

CA: Cape Alava (Bowlby et al. 1988)
CJ: Cape Johnson (Bowlby et al. 1988)
SP: Sand Point (Bowlby et al. 1988)
DP: Duk Point (Bowlby et al. 1988)
OC1: Outer coast, south of Cape Flattery, 1994 (Jameson 1994a)
OC2: Outer coast, south of Cape Flattery, 1995 (Jameson 1995a)
TA: Tatoosh Island, 1997& 1998 (Jameson 1998a)
CF1: East of Cape Flattery, 1995 (Jameson 1995a)
CF2: East of Cape Flattery, 1996 (Jameson 1996a)
CF3: East of Cape Flattery, 1997 (Jameson 1998a)
CF4: East of Cape Flattery, 1998 (Jameson 1998a)

POPULATION STATUS

North Pacific

The size of the original North Pacific sea otter population is unknown, but may have comprised 100,000 to 300,000 animals (Kenyon 1969, Johnson 1982, Marine Mammal Commission 1997). Intense, unregulated harvest of sea otters began in 1741, with the discovery of Alaska, the Aleutian Islands, and the commander Islands by the Bering Expedition (Riedman and Estes 1990) and continued for about 50 years before conservation measures were put into place (Estes 1980). A second period of overexploitation began in the mid-1800's and reduced the species throughout its range. As a result, the sea otter population approached extinction. By the time the otter received protection in 1911, as few as 1,000 to 2,000 animals survived, scattered in 13 small remnant groups in Russia, the Aleutian Islands, Alaska, British Columbia, California, and Mexico (Kenyon 1969, Riedman and Estes 1990). The small populations in Mexico and British Columbia declined to extinction (Kenyon 1969). After several decades of protection from commercial harvest, the sea otter population numbers at least 126,000 (Gorbics et al. 2000), but the species still has not become re-established in much of its former range.

Washington

Original population. Little information exists on population size and exact distribution of sea otters living between the mouth of the Columbia River and the Strait of Juan de Fuca before the population was extirpated. Sea otters are presumed to have lived along much of the outer coast for several thousand years. The population was probably near carrying capacity, but may have been locally reduced by hunting. Sea otter remains have been found at archaeological sites at Cape Alava (Huelsbeck 1983, cited in Bowlby et al. 1988), at the Hoko River east of Neah Bay (Wigen 1982, cited in Bowlby et al. 1988), and at Sucia Island in the San Juan archipelago (Kenyon 1969).

In 1790, Spanish explorer Manuel Quimper traded copper sheets for sea otter pelts at Neah Bay and Dungeness Bay (Wagner 1933). He also traded, at Discovery Bay, for live sea otters captured north of the bay in the “interior” of the Strait of Juan de Fuca. In 1792, Captain Robert Gray sailed the *Columbia*, the first sea otter ship outfitted in America, along the coast of Washington. The pursuit of the sea otter was the primary object of the expedition. In April, somewhere along the Olympic Peninsula coast, crew of the ship traded with Indians, exchanging copper and iron for sea otter pelts (Scheffer 1940). Later in May, Captain Gray purchased 150 sea otter skins during an 8-day stay at the mouth of the Columbia River (Scheffer 1940). In spring of the same year, Peter Puget explored the entirety of Puget Sound. Although he commented on animals encountered, and traded for sea otter skins in some localities, he did not report any live sea otters during the voyage

(Anderson 1939). Elmendorf (1960) stated sea otters were rare strays in Hood Canal, but presented no evidence for the claim.

Available historical data (Wagner 1933, Scheffer 1940, Kenyon 1969) indicates that few sea otters occurred as far east as the San Juan Islands and Discovery Bay, and that none lived in Puget Sound. Gerber and VanBlaricom (1999) discussed the lack of historical evidence of sea otters in these areas and noted that this was a puzzling pattern given the large numbers of sea otters known to occur in similar coastal estuaries in Alaska and, historically, California (Kenyon 1969). Hunting by Native Americans and the occurrence of paralytic shellfish poisoning in sea otter prey have been suggested as explanations for the absence of sea otters from Puget Sound (Kvitek 1990); but to date, definitive explanations are lacking (Gerber and VanBlaricom 1999).

In British Columbia, Pitcher (1998) speculates that sea otters were present in the Strait of Georgia 500 years ago and in more ancient time (8,000 years ago), despite the lack of evidence from middens. He notes that, although there appear to be no specific references to sea otters in the Strait in Captain George Vancouver's 1792 travel log, only 15 years before that, native peoples were pursuing fur trade with Europeans. He didn't think it was surprising that written records of sea otters in the Strait had not been discovered. He suggests that local extinction could have occurred rapidly in the enclosed calm waters and islands of the Strait. He theorized that sea otters could have easily been wiped out during this period and concludes that the lack of evidence should not be construed to mean they were absent from the ecosystem. Because similar habitats to the north and south of the Strait of Georgia undoubtedly held sea otters, and still do in Alaska , he believed it was "stretching credulity to suppose that they were absent from the ancient Strait of Georgia."

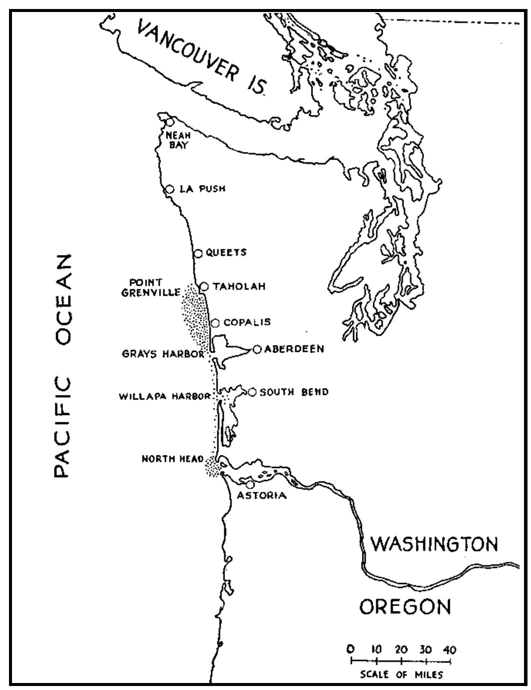

Figure 2. Nineteenth-century range of the sea otter in Washington, as illustrated by Scheffer (1940). Map reproduced with permission from *Pacific Northwest Quarterly*.

Lewis and Clark found sea otters at the mouth of the Columbia River in the winter of 1805/1806 (Burroughs 1995). Scheffer's (1940) distribution map included this locality, as well as Willapa Bay, but treated the intervening Long Beach peninsula as relatively unimportant (Fig. 2).

In the mid-1800's (and presumably earlier), sea otters were concentrated between the mouth of Grays Harbor and Point Grenville (Fig. 2). Scammon (1870:70-71) described this area as "the most noted grounds" for sea otter harvest between San Francisco and the Strait of Juan de Fuca. The only written record of the sea otter's former abundance is based on Scheffer's (1940) interviews with long-time coastal residents. His sources spoke of sea otter "herds" that regularly numbered in the tens or hundreds. By the early 20th century, though, the population had become so small that few people targeted sea otters for harvest. The last sea otters shot in the state were taken from Willapa Bay about 1911 (Scheffer 1940). The species was probably extirpated shortly thereafter.

Scheffer (1995) referenced a letter reporting a single-day sighting in July 1949 of several sea otters at Goodman Creek, which is about 13 km (8 mi) south of LaPush. It is likely this report was of river otters (R. Jameson, pers. comm.). Reports of river otters as sea otters frequently occur. If these were sea otters, they would have either had to have roamed to Washington from Alaska or California, or been a small relict population that remained undetected along the Washington coast for decades. Information on sea otter movements argues strongly against otters wandering in from Alaska or California. In 1949 the California sea otter population was still very small, and concentrated many miles south of Monterey. The nearest Alaska population would have been in Prince William Sound. It is highly unlikely they would have wandered from either location. This report is most likely an incorrect identification (R. Jameson, pers. comm.).

Reintroduced population. Fifty-nine sea otters were translocated to the Washington coast from Amchitka Island, Alaska in the summers of 1969 (29 otters) and 1970 (30 otters) (Figure 1). The 59 released otters included 41 females and 18 males (Bowlby et al. 1988). Otters in the 1969 group were released directly to the open ocean near Point Grenville. At least 14 of the otters in the 1969 group died within a few days after release, presumably due to fur soiling and stress of travel (Kenyon 1970). Two other otters in this group were later killed by gunshot (Kenyon 1970).

In 1970, the release site was changed to La Push, within the boundaries of Olympic National Park and near the middle of the best sea otter habitat in Washington (Jameson 1998b). The otters were held in floating pens for several days prior to release at Cake Island, north of La Push (Fig. 1). This enhanced the group's survival; no immediate mortality was documented. Sea otter sightings were sporadic for several years after the translocations, and no observer counted more than 10 otters through 1976 (Jameson et al. 1982, Bowlby et al. 1988). Thus, Washington's present-day population descended from no more than 43 otters, and maybe as few as 10 (Jameson et al. 1982). Reproduction was first documented in 1974 when 7 independent otters and 2 pups were observed near Destruction Island (Jameson et al. 1982). Pups have been seen in all subsequent surveys.

Current population numbers. The first systematic survey of Washington's reintroduced sea otter population took place in 1977 between 18 June and 4 July (Jameson and Kenyon 1977). U.S. Fish and Wildlife Service biologists covered 65 km of coastline by boat, from Destruction Island north to Bodelteh Islands, and searched 20% of the adjacent beaches for carcasses and skeletal material. Nineteen otters, including 4 pups, were observed (Table 3, Jameson et al. 1982). Boat surveys in 1978 covered the northern portion of the range; inclement weather conditions precluded a through survey of the southern portion of the range. In 1981, the entire coastline from Destruction Island to Neah Bay was covered (Jameson et al. 1982). U. S. Fish and Wildlife Service surveys, using a combination of boat and ground counts, continued every other year through 1987, and attempted to survey all potential sea otter habitat on the Washington coast (Table 3).

Table 3. 1977-1988 sea otter counts in Washington. Both independent otters and pups are included.

Source	77	78	79	80	81	82	83	84	85	86	87	88
USFWS/USGS [a]	19	12	–	–	36	–	52	–	65	–	99 [b]	
WDFW et al.[c]	10	14	14	15	45	14	60	48	46			99
WDFW [d]										67	107	

[a] U.S. Fish and Wildlife Service/Biological Resource Division of USGS sea otter surveys (Jameson et al. 1998b; R. Jameson, unpublished data)
[b] The total for 1987 has been adjusted upward from the total presented previously because of an error in addition in the original data set (R. Jameson, pers. comm.).
[c] Sea otter observations during WDFW harbor seal flights, and from other reliable sources (summarized in Bowlby et al. 1988, S. Jeffries, unpublished data)
[d] Sea otter surveys, Bowlby et al. 1988

Another source of sea otter population data between 1977 and 1985 and in 1988 came from observations by a WDFW biologist who recorded sea otter observations during aerial surveys of harbor seals (Table 3) (S. Jeffries, unpublished data, summarized in Bowlby et al. 1988; S. Jeffries, pers. comm.). Sea otter sightings were recorded during 34 complete and partial coastal flights between 1977 and 1985 (Bowlby et al. 1988). Between 1977 and 1980 the highest count of otters was 19. During 1981 and 1985 otter numbers increased to a high count of 65 (Fig. 3). In 1986 and 1987, WDFW biologists used combined aerial and ground surveys along the Olympic coast; the high count in September 1987 was 107 otters (Table 3). Applying a sightability correction factor for animals missed in the survey, they estimated the population to contain 136 otters (Bowlby et al. 1988). Beginning in 1989, and continuing to the present, USFWS Research Division (now the Biological Resources Division of the USGS) and WDFW biologists have conducted joint annual aerial and ground sea otter surveys along the Washington coast (Fig. 3, Appendix A).

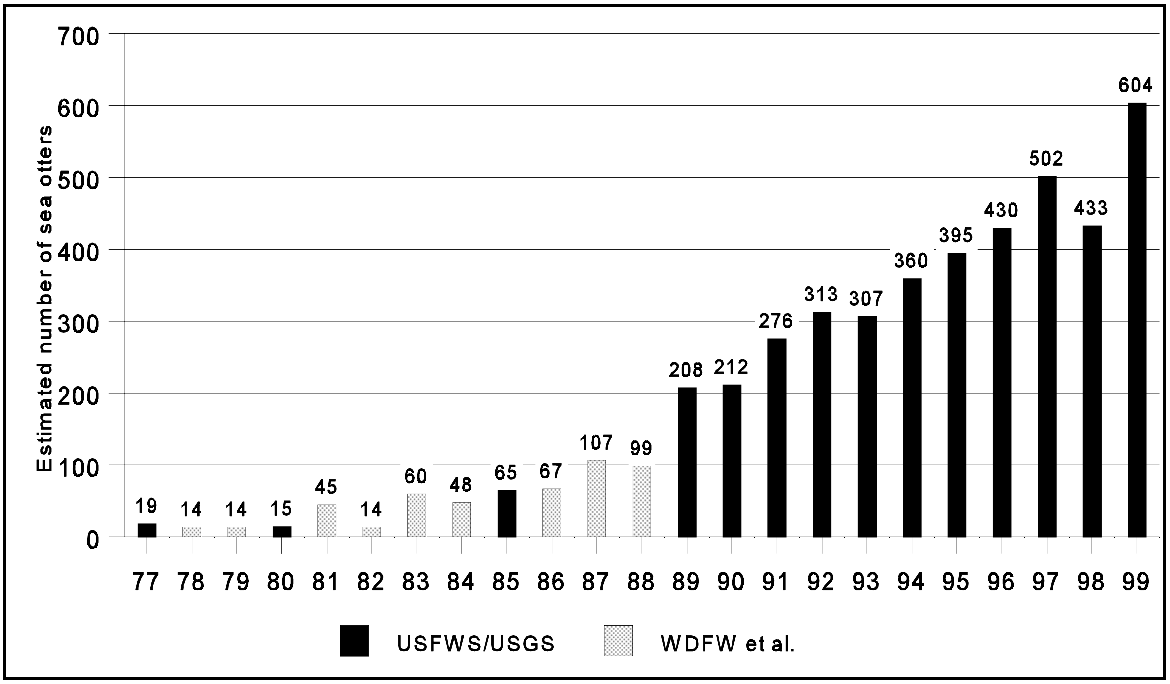

Figure 3. High counts of Washington sea otters, 1977-1999, from surveys and observations by USFWS/USGS (Jameson et al. 1986; R. Jameson, USGS Biological Resources Division, unpublished data), WDFW and others (summarized in Bowlby et a. 1988, and S. Jeffries, WDFW, unpublished data). 1989-99 surveys conducted jointly by USFWS/USGS-WDFW. Both independent otters and pups are included.

From 1977 to 1989, Washington's sea otter population grew at near the maximum rate of increase for sea otter populations of 17-20% yr (Jameson 1998a). From 1989 to 1996, the population increased from 208 to 430 animals (Fig. 3), at an estimated rate of increase of about 11.4% (Figure 3; Jameson 1994b, 1995b, 1996b 1997b). It is unknown whether the difference between the growth rates indicates an actual slow-down in the population growth or is attributable to a change in survey techniques in 1989 (Jameson 1998b).

In July 1999, a total of 605 sea otters were observed, including 555 independent animals and 50 pups (Jameson and Jeffries 1999) (Figure 3). In July 1998, 433 otters (389 independents, 44 pups) were observed (Jameson and Jeffries 1998). The 1998 count suggested a possible decline, but Jameson and Jeffries (1998) speculated that it was likely the result of a shift in otter distribution to offshore areas that were missed in the aerial survey route. The 1999 survey results were an increase of nearly 40% over the 1998 count, which is beyond the maximum reproductive potential for sea otters. This supports the theory that the 1998 survey results were an anomaly (Jameson and Jeffries 1999).

Distribution. In 1977 Washington's sea otters ranged primarily from Destruction Island to Cape Alava, a distance of about 60 km (Table 4, Fig. 4; Jameson 1998b). In the fall of 1985 a single male otter was recorded at Neah Bay on six occasions (Calambokidas et al. 1987). In 1987, the sea otters were distributed along 70 km of the coast from Destruction Island to Point of the Arches, primarily between Duk Point and Cape Johnson, with a small, disjunct aggregation at Destruction Island (Bowlby et al. 1988). In 1991, a large group of otters moved north and established itself in Makah Bay, expanding the range to about 80 km (Jameson 1998b). In the winter of 1995, a group of more than 100 sea otters entered the western Strait of Juan de Fuca near Neah Bay (Jameson 1995b) and animals have returned there every winter since (R. Jameson, pers. comm.). In late 1995, a small group of females rounded Cape Flattery and established near Slant Rock, an area that previously was inhabited almost entirely by male sea otters (Jameson 1998b). By 1996, the otter distribution ranged from Destruction Island to Neah Bay, a distance of about 110 km (Fig. 4). In 1997, and each year since, females with pups have been observed at Koitlah Point, about 2.5 km west of Waddah Island, near the entrance to Neah Bay (R. Jameson pers. comm.).

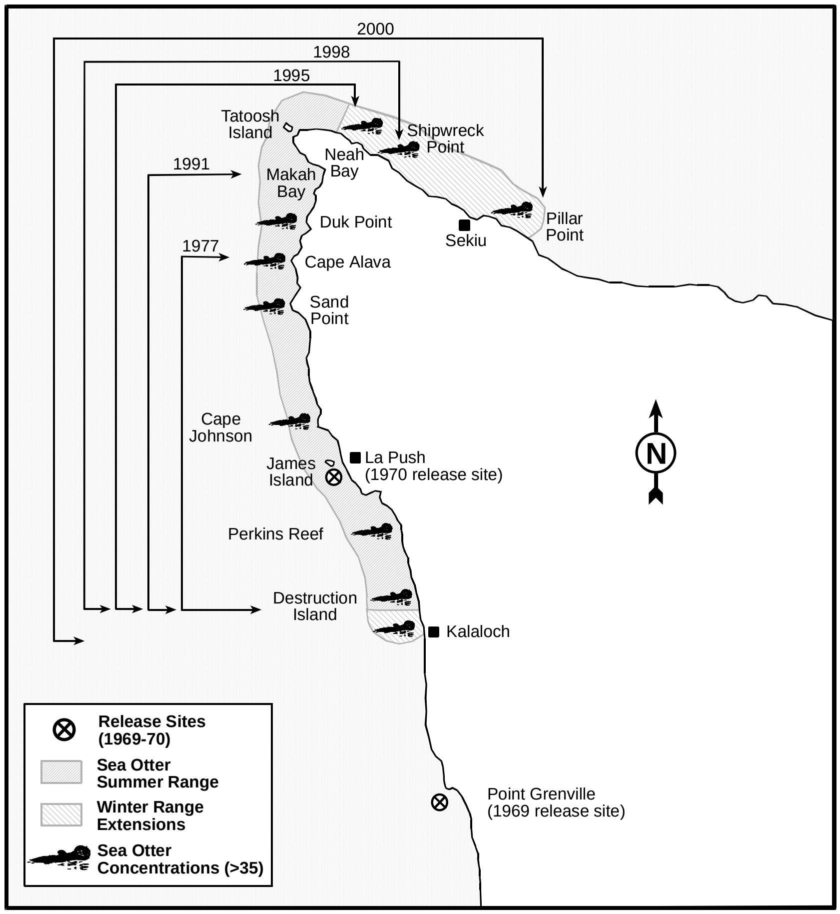

Figure 4. Changes in distribution of the Washington sea otter population, 1977-2000 and 1999-2000 concentrations of sea otters along the Washington coast (R. Jameson 1998b; R. Jameson and S. Jeffries, pers. comms.).

In the winters of 1998 and 1999, the group of about 100 male sea otters, which had been moving to Neah Bay during the winters since 1995, moved 15 km further east of Neah Bay to Shipwreck Point (Fig. 4, R. Jameson, unpublished data). In February 2000, winter range extensions were observed in both the Strait of Juan de Fuca and at the southern end of the range (Fig. 4). In the Straits, a group of 56 otters was seen between Slipp Point and Pillar Point, about 8 km east of Sekiu, (S. Jeffries, pers. comm.); and at the south end, 43 sea otters were seen near Kalaloch, about 10 km down coast from Destruction Island (R. Jameson, pers. comm.).

In 1999, Jameson and Jeffries (1999) found major changes in the distribution and density of sea otters in the three segments of the summer range (Table 4). A large number of sea otters shifted distribution to the southern end of the range; primarily at Destruction Island and Perkins Reef. The number of otters at Destruction Island increased by 66% (from 103 to 171) and the Perkins reef count increased by 5 times what it was in 1998 (from 13 to 85) and by nearly 3 times what it was in 1997 (31) (Appendix A). The third major change occurred in the middle portion of the range from James Island to Cape Alava: a large group of 56 otters was found for the first time offshore from Cape Johnson. No animals had been observed in this area during previous surveys. The area from Perkins Reef to just south of Cape Johnson continued to have very few otters (Appendix A, Fig. 4), even though habitat in the area appears to be good (Jameson and Jeffries 1999).

Table 4. Number and density of sea otters (number of otters per km of coastline) for three segments of the Washington coast surveyed 1997-99 (Jameson and Jeffries 1999).

	1997		1998		1999	
Segment	Total (%)	Density	Total (%)	Density	Total (%)	Density
North						
Tatoosh Island-Cape Alava	62 (12)	2.0	32 (7)	1.0	71 (12)	2.3
Central						
Cape Alava-James Island	322 (64)	9.2	284 (66)	8.1	276 (46)	7.9
South						
James Island-Destruction Island	118 (24)	4.5	117 (27)	4.6	258 (43)	9.9

Jameson and Jeffries (1999) also found changes in the density and relative distribution of sea otters in the south and central portions of the Washington range in 1999 (Table 4). In 1997 and 1998, the central portion of the range held about 64-66% of the population; and the south portion held about 24-27%. In 1999, the proportion of the population in the south and central areas nearly equalized (43-46%) and the density of sea otters in the south portion more than doubled from 4.5 to 9.9 otters per km coastline (Table 4, Jameson and Jeffries 1999). The primary concentrations of sea otters (>35) in the central portion of the range occur at Cape Alava, Sand Point, and Cape Johnson; in the south at Perkins Reef and Destruction Island; and in the north at Duk Point (Fig. 4).

British Columbia

Sea otters were hunted to extinction in British Columbia, but were successfully reintroduced to the west coast of Vancouver Island. Between 1969 and 1972, 89 sea otters were reintroduced to Vancouver Island in a series of three introductions (Bigg and MacAskie 1978). By 1997, the population along the west coast of Vancouver Island included more than 2,000 sea otters, with the population growing at a rate of 18.6% per year. (Watson et al. 1997). An additional population, with 259 otters in 1996, is located about 150 km north of Vancouver Island. The origins of this group of otters are uncertain (Watson et al. 1997). Both groups are expanding their ranges. In 1997, the west coast population ranged from Cape Scott, at the northern tip of Vancouver Island, to Estevan Point, halfway up the west coast of the island (Watson et al. 1997). In March 2000, a group of 131 otters were observed just south of Estevan Point (S. Jeffries, pers. comm.), which is approximately 160 km (100 mi) northwest of Cape Flattery. This was the first time a large group of otters had been seen south of Estevan Point; and it is the nearest sea otter population to Washington.

HABITAT STATUS

Ownership and Management

Most of the current sea otter range is within the Olympic Coast National Marine Sanctuary, which extends from the Copalis River mouth in Grays Harbor County to Koitlah Point on the west side of Neah Bay, Clallam County. The sanctuary recognizes the sea otter as a special species for the Olympic coastal ecosystem (C. Bernthal and E. Bowlby, pers. comm.).

Four Indian reservations are situated on the north coast of Washington: Makah, Quileute, Hoh, and Quinault. Other uplands adjacent to the sea otter range are owned by the National Park Service and managed as Olympic National Park. Rocks and islands off coastal Washington are encompassed by three national wildlife refuges: Copalis, Quillayute Needles, and Flattery Rocks. These rocks and islands are managed by the U.S. Fish and Wildlife Service as the Washington Maritime National Wildlife Refuge Complex.

Within the range of sea otters, most tidelands are publicly owned and under the jurisdiction of the Washington Department of Natural Resources (DNR). Tidelands adjacent to Indian reservations are typically under tribal ownership. Bedlands are state-owned out to 3 miles offshore and managed by DNR.

Environment

Throughout much of the current sea otter range in Washington, coastal areas are fairly pristine. Areas under federal jurisdiction should remain so with protection from the National Oceanic and Atmospheric Administration (Olympic Coast National Marine Sanctuary), U.S. Fish and Wildlife Service (Washington Maritime National Wildlife Refuge Complex), and National Park Service (Olympic National Park). To the south, development has been moderate to extensive; most of coastal Grays Harbor County bears residential, resort, and industrial developments. To the east, considerable development has occurred along the shores of Puget Sound and, increasingly, the Strait of Juan de Fuca. Some relatively undisturbed habitat remains, however, around the San Juan Islands and other regions where otters may eventually spread. The quality of these areas for sea otters may depend in part upon types and levels of water-based human activities.

Sea otters are usually associated with kelp forests. Changes in kelp abundance and distribution in Washington have occurred over the past 150 years, but the nature of those changes is poorly known. In the mid-1800's, members of coastal tribes reported large patches of kelp several miles seaward of Point Grenville (Scheffer 1940:379), but Scammon (1870) was unable to find them. If these beds truly existed, they apparently no longer occur. Their presence may have been important to the large number of sea otters that supported 19^{th}-century hunts near Point Grenville. Their demise might be attributable to human-related effects such as dredging and increased erosion. Sedimentation can disrupt recruitment and growth of kelp (Devinny and Volse 1978).

People removing kelp from Washington waters do so mainly when harvesting herring roe. Most harvest occurs at mariculture facilities in the Strait of Juan de Fuca, east of the current range of sea otters. Most non-tribal kelp used in the Washington herring-roe fishery is imported from British Columbia. Tribal kelp needs are met through harvest in the outer Strait and by some mariculture.

Recently, kelp cover in Washington has been relatively stable, as revealed by an 8-yr kelp inventory between Port Townsend and the Columbia River (Van Wagenen 1999). It is difficult to predict what changes in kelp communities may occur as sea otters expand their range. Currently available kelp forest habitats on the outer coast of Washington are fully occupied by sea otters, so future sea otter population growth is not likely to cause significant changes in those kelp communities (Gerber and VanBlaricom 1999). In areas now lacking sea otters in Washington, but likely to have them in the future, Carter and VanBlaricom (1998), Gerber and VanBlaricom (1999) and Carter (1999) provide evidence and arguments that the typical widely perceived enhancement of kelps, fishes, and other components of kelp forest communities may not occur. There is considerable kelp forest habitat in the Strait of Juan de Fuca that is not currently occupied by sea otters. Gerber and VanBlaricom (1999) looked at six models to predict impacts of sea otter expansion into the

Strait of Juan de Fuca. Several of the models predicted expanded kelp communities, but at least two suggested that sea otters would not cause the type of community modification described for other locations in the North Pacific. They concluded available data were not adequate to anticipate effects of sea otters on kelp forests in the Strait. Carter (1999) found that two years of simulated sea otter predation did not result in significantly higher densities of kelp species in the study. However, she noted that the scale and time period of the experiments may have influenced the results: sea otter predation may only affect algal communities over a longer time period; the scale of the experiment may have been too small to observe changes that would normally be associated with reoccupation of the area by sea otters; and algal recruitment may have been poor during the study. Observations suggested that kelps were not being regulated by sea urchin grazing in the San Juan Channel; and that other factors such as recruitment frequency or grazing by other herbivores may regulate kelp communities in that area.

CONSERVATION STATUS

Legal Status

Washington.—The Washington Department of Game's (predecessor to Washington Department of Fish and Wildlife) authority to manage marine mammals was clarified in 1971 (RCW 77.08.050). Subsequently, the Department adopted Washington Administrative Code (WAC) 232-12-660 to protect marine mammals as managed wildlife, but this Code was repealed in 1981. State laws and regulations pertaining to marine mammals, including sea otters, were superseded by the federal Marine Mammal Protection Act of 1972.

In October 1981, the Department designated the sea otter as State Endangered under the Special Species Policy (policy 602). The listing was based on the sea otter's small population size, restricted distribution, and vulnerability. In 1990, the Washington Wildlife Commission reaffirmed the sea otter's State Endangered designation under WAC 232-12-014. State Endangered status was defined to include, "any wildlife species native to the state of Washington that is seriously threatened with extinction throughout all or a significant portion of its range within the state" (WAC 232-12-297).

United States.—Sea otters are protected under the Marine Mammal Protection Act of 1972 (MMPA). Under the MMPA, sea otter stocks are the responsibility of the Secretary of the Interior. The Secretary has designated the U.S. Fish and Wildlife Service with the authority to implement the MMPA as it pertains to sea otters.

Under the MMPA, sea otters are protected by a prohibition on take—"to harass, hunt, capture, or kill, or attempt to harass, hunt, capture or kill." The term harassment was defined in 1994 to mean, "any act of pursuit, torment, or annoyance which, 1. (Level A Harassment) has the potential to injure a marine mammal or marine mammal stock in the wild; or 2. (Level B Harassment) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption or behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering." Provisions within the MMPA allow ceremonial and subsistence harvest of sea otters by coastal Alaskan natives (16 USC 1371, section 101(b)). Take may also be permitted under special circumstances, such as protecting human life, scientific research, public display, and photography for educational or commercial purposes.

The sea otter subspecies found in Washington, British Columbia, and Alaska (*E. l. kenyoni*) has not been listed under the federal Endangered Species Act. However, the southern sea otter (*E. l. nereis*), which does not occur in the state, has been listed as Threatened in Washington, Oregon, California, and Baja California (U.S. Fish and Wildlife Service 1977). A recovery plan for the southern sea otter was approved in 1982 (U.S. Fish and Wildlife Service 1982). In 1996, when the otter population numbered approximately 2,377 and was increasing about five percent per year, the USFWS released a draft revised recovery plan for public comment (U.S. Fish and Wildlife Service 1996). Before the plan was finalized, the sea otter population began to decline significantly. Studies found disease and contaminants in recovered carcasses. The recovery team determined that the draft plan was not adequate to address the declining otter population and the factors affecting the population. A new revised draft recovery plan was written and released for public comment in February 2000 (U.S. Fish and Wildlife Service 2000). The new plan focuses on identifying causes of the sea otter decline and eliminating activities that may negatively impact the otters. The Spring 2000 survey in California indicates the decline observed since 1995 may have reversed. The count was 2,317, just 60 otters below the 1995 high count (R. Jameson, pers. comm.).

International.—The sea otter was first afforded international protection early this century, when it was included under the Treaty for the Preservation and Protection of Fur Seals (37 Stat. 1542, T.S. no. 564). The Treaty was signed in 1911 by Japan, Russia, the United Kingdom (for Canada), and the United States. Under the treaty, sea otters were protected in international waters—those at least 3 miles offshore (U.S. Fish and Wildlife Service 1982). Later, the Fur Seal Act of 1966 provided protection on the high seas. The National Marine Fisheries Service has consolidated the provisions of the Fur Seal Act into regulations promulgated under the Marine Mammal Protection Act.

MANAGEMENT ACTIVITIES

Reintroduction

Between 1965 and 1972, 708 sea otters were captured in Alaska and reintroduced into unoccupied habitat in Alaska, British Columbia, Washington and Oregon; 59 otters were translocated to Washington in 1969 and 1970 (Jameson et al 1982). Reintroductions to Washington, British Columbia, and Alaska (except St. George Island) were successful, but the Oregon effort failed (Jameson et al. 1982).

Translocation was identified by the Southern Sea Otter Recovery Team as an action that could broaden the geographic range of sea otters in California, thereby minimizing the chance that a single catastrophic oil spill would affect the entire population. The U.S. Fish and Wildlife Service and California Department of Fish and Game attempted to establish an otter colony at San Nicolas Island, southwest of Los Angeles. Between 1987 and 1990, 139 otters were moved to San Nicolas Island from the central coast. To date, the colony has not become established; 23 sea otters were counted at San Nicolas Island in October 1999 (Jameson, pers. comm.). The revised recovery plan for the southern sea otter (U.S. Fish and Wildlife Service 2000) includes a recommendation to declare the San Nicolas translocation program a failure. Reintroductions may fail in part because sea otters are faithful to their established home ranges and freely leave unfamiliar habitats (Jameson et al. 1982, Estes et al. 1993).

Surveys

Surveys of the sea otter population in Washington have been conducted biennially by USFWS/USGS since 1977. Since 1989, USGS and WDFW researchers have conducted joint annual ground and aerial sea otter surveys.

Research

In addition to monitoring distribution and abundance, biologists from WDFW, USGS Biological Resources Division, U.S. Fish and Wildlife Service, and other researchers have been studying sea otter ecology in Washington. Research includes determining survival rates, reproductive rates, pre-weaning survival, causes of mortality, time budgets, diet, movements, and social behavior. Investigations have also addressed changes in benthic communities and prey availability. Between 1994 and 1998, 83 Washington sea otters were captured and 63 were implanted with radio transmitters (Jameson 1994a, 1995a, 1996a, 1997a, 1998a). By tracking individual otters, researchers have obtained data on otter movements, time budgets, feeding behavior, and prey selection.

Oil Spill Risk Reduction and Response

The Olympic Coast National Marine Sanctuary has identified an Area To Be Avoided by oil tankers and vessels carrying hazardous materials. The area encompasses the northern coast and westernmost Strait of Juan de Fuca (Tatoosh Island to Seal and Sail Rocks). Its intent is to reduce impacts on shoreline areas by keeping vessels, and therefore oil spills, well offshore. The Area To Be Avoided is advisory; compliance is not mandatory.

In the event of an oil spill, portions of the outer coast are provisionally approved for in-situ burning, a method to remove oil from the water's surface through controlled ignition and burning. Additionally, the use of chemical dispersants is allowed in certain offshore areas along the outer coast. Either of these methods is limited by environmental conditions and other spill-specific factors.

Fishery Interactions

For 25 years after sea otters were reintroduced to Washington, they were not known to have appreciably affected commercial, tribal, or recreational fisheries. More recently, however, with the expansion of the sea otter population and range, fishery interactions have begun to occur. If sea otters continue to broaden their range in the state, they will encounter more prey populations that are also harvested by people. Likewise, if otters shift prey selection, new interactions may occur.

Elsewhere in their range, sea otters have contributed to the loss or reduction of certain commercial and recreational shellfisheries (Estes and VanBlaricom 1985). But otters have likely enhanced some fin fish populations that benefit from their tendency to restore kelp forests through predation on sea urchins.

While sea otters can have a significant impact on shellfisheries, cause-effect relationships between otter presence and fishery viability are frequently unclear. In particular, many shellfish life histories are poorly understood. Changes in recruitment and fecundity, as well as short- and long-term effects of intensive harvesting, may confound biologists' attempts to manage fisheries in areas where sea otters occur.

Some authorities consider further expansion of Washington's sea otter population unlikely, while others consider it inevitable. It is not possible to predict whether the population will continue to grow and spread and, if so, at what rate and in which direction. Gerber and VanBlaricom (1999) reviewed the potential for sea otter-fishery conflicts in Washington. They predicted potential future interactions with razor clams, Dungeness crab, sea urchins and abalones if the sea otter population expands into areas occupied by those species.

As the Department is considering sea otter recovery actions for the next 50 to 100 years, it is advisable to present a fairly thorough review of fisheries currently or potentially affected by sea otter presence. The following sections should not be read as announcements of imminent threat to various fisheries, but as informational notes for an uncertain future.

Sea urchin. In Washington, sea urchins (primarily red sea urchins, *Strongylocentrotus franciscanus*) are found on rocky bottoms in the Strait of Juan de Fuca, around the San Juan Islands, and on the outer coast. Until recently, sea otters were not found in areas supporting significant urchin fisheries. With their recent movement into Neah Bay and further eastward, however, otters have begun to impact urchin-harvest areas.

Washington supports commercial, tribal, and recreational fisheries for sea urchins. The sea urchin harvest averaged 6.3 million pounds per year between 1988 and 1992, with an average value of $3 million annually (Hoines 1996). Districts in the San Juan Islands and Strait of Juan de Fuca currently provide most of the catch. Current levels of red sea urchin commercial harvest in Washington may not be sustainable, regardless of otter presence (Carter 1999).

A treaty fishery for sea urchins developed in the Neah Bay area during the 1980's. Total harvest increased from 20,000 pounds in 1982/83 to 1.6 million pounds during the first 3 months of the 1987/88 season (A. Bradbury, pers. comm. cited in Kvitek et al. 1989). During the winter of 1994/95, at least 100 sea otters, dominated by young males, began annual movements into Neah Bay (an exclusive Makah tribe fishing zone). Surveys completed in summer 1997 revealed that few sea urchins remain in the Neah Bay vicinity (A. Bradbury, pers. comm.).

Urchin fisheries very likely cannot exist where sea otters live (Estes and VanBlaricom 1985). Sea urchin abundance is lower where sea otters have become established than where otters are absent (Jameson et al. 1986, Kvitek et al. 1989, Watson 1993, Estes and Duggins 1995, Kvitek et al. 1998). Gerber and VanBlaricom (1999) concluded that commercial and recreational fisheries for sea urchins could not survive full reoccupation of pre-exploitation habitats by sea otters in Washington. Intense predation by otters, combined with a low recruitment rate of urchins, and high number of alternative sea otter prey in urchin habitats, preclude a sustainable harvest.

Dungeness crab. In Washington, Dungeness crabs (*Cancer magister*) are found on sandy bottoms along the outer coast, within the Strait of Juan de Fuca, and in north Puget Sound. Crabs are most productive and broadly distributed from La Push southward. On the outer coast, crabbing occurs from nearshore (waters less than 10 fathoms in depth) to well offshore.

Sea otters impacted the Dungeness crab fishery in east Prince William Sound, Alaska, when they moved into the area in the early 1980's. Within a year after large numbers of otters entered the area, the commercial crab fishery was closed due to low crab abundance (Garshelis et al. 1986).

The Dungeness is the only crab of commercial importance in Washington. The fishery has grown rapidly; an estimated 100,000 crab pots are now in use (LaRiviere and Barry 1997). Crabbers landed an average of more than 14 million pounds of Dungeness crab annually between 1988 and 1992, representing an average value of $17.3 million per year (Hoines 1996). The 1994/1995 season harvest totaled 19.7 million pounds and represented a record value of $33.8 million (LaRiviere 1996). Tribal harvests have been light in comparison; during the 1994/1995 season, the combined harvest of the Quileute and Quinault tribes totaled less than 200,000 pounds (LaRiviere 1996).

Most of Washington's Dungeness crab harvest occurs in waters deeper than those typically used by otters, with more than half the harvest occurring beyond 3 miles offshore (LaRiviere and Barry 1997). However, hundreds of crab pots are placed in nearshore waters less than 10 fathoms deep (P. LaRiviere, pers. comm.). At this depth, they are accessible to otters and could pose an entrapment hazard.

If sea otters expand their range toward the shallow, enclosed waters of Grays Harbor and Willapa Bay they would be within major crab nurseries that could be highly vulnerable to predation. Gerber and VanBlaricom (1999) noted this relationship in their evaluation of the potential interaction of sea otters and Dungeness crabs in Washington. They concluded that the effect of sea otters on Dungeness crabs would be the most severe in areas where fisheries focus on shallow habitats, such as the Dungeness spit region in the eastern Strait of Juan de Fuca. They also predicted significant reductions in crab harvests if sea otters eventually expand southward and occupy the estuaries of Grays Harbor and Willapa Bay.

Razor clams. In Washington, most razor clams (*Siliqua patula*) are found in the sand beaches between the Columbia River and Moclips, but the clams range northward as far as Makah Bay. Sea otter and razor clam ranges overlap only slightly now, at Makah Bay and near Kalaloch. When otters lived south of Point Grenville during the mid- to late-19th century, however, "the flesh of razor clams was often found in stomachs of the sea otter, and the otters were believed to be most abundant where the clams were plentiful" (Scheffer 1940:382).

Sea otters are suspected to have compromised the subsistence harvest of razor clams by the Makah tribe on north-coast beaches (S. Joner, pers. comm.). If Washington's sea otters expand their range southward, they could consume razor clams that now support a highly popular recreational fishery, as well as tribal and non-tribal commercial fisheries. Gerber and VanBlaricom (1999) predicted that Washington's razor clam recreational fishery would be vulnerable to sea otter predation if otters occupy the preferred habitats of razor clams along the southern outer coast of Washington.

Four major razor clam “management beaches” are monitored by fish biologists in the WDFW Marine Resources Division—Long Beach, Twin Harbors, Copalis, and “Mocrocks” (Moclips to Roosevelt Beach). Among these, Long Beach and Copalis are favored by diggers; clams taken from these two beaches in spring 1995 represented 80% of the season’s non-Indian recreational harvest (Ayres and Simons 1997). For all beaches, the combined spring and fall harvests for 1995 attracted 383,000 diggers who took some 5.5 million clams (Ayres and Simons 1997). Effort and success in the razor clam sport fishery have varied widely since 1949, with the most recent peak of over 13 million clams being taken during nearly 1 million digger trips in 1979 (Ayres and Simons 1997). A typical spring opening in 1994 brought several thousand clammers to the beaches, with more than 20,000 diggers present on some days (Ayres and Simons 1997).

The Quinault Indian Nation began holding an off-reservation commercial razor clam harvest at “Mocrocks” beach in 1993. From fall 1994 through spring 1995, tribal members harvested 625,973 clams in 34 digging days with up to 220 participants per day (Ayres and Simons 1997). The Quinault also maintain a ceremonial and subsistence harvest at Kalaloch.

The non-treaty commercial razor clam harvest is limited to sand spits in Willapa Bay. The average annual harvest for recent seasons (1989-1991, 1994) was 23,000 pounds, with 95 licensed clammers (a record low) taking 21,500 pounds in 1994 (Ayres and Simons 1997). From 1989 to 1991, average annual value of the commercial harvest was about $43,000 (Hoines 1996).

Abalone. In Washington, pinto abalones (*Haliotis kamtschatkana*) are found in kelp forests and on other rocky substrates along coastlines of the Strait of Juan de Fuca and the San Juan Islands (West 1997). Sea otter and pinto abalone ranges currently overlap south and east of Cape Flattery.

Sea otters in Morro Bay, central California, were implicated in the reduction of red abalone (*Haliotis rufescens*) density from 0.1010 abalone/m^2 to 0.0072 abalone/m^2 between 1965 and 1993 (otters arrived in 1967), with an estimated population reduction from 253,350 to 18,050 abalones (Wendell 1994). The commercial abalone fishery ended and the sport fishery now is limited. Abalone life history characteristics make them vulnerable to rapid overharvest, so sea otter predation may not be wholly responsible for the fishery’s decline (Estes and VanBlaricom 1985).

Washington currently does not support commercial or recreational fisheries for abalone. Recreational harvest was closed by regulation in 1994. However, illegal harvest apparently occurs in the San Juan Islands and Strait of Juan de Fuca (A. Bradbury, pers. comm.). Gerber and VanBlaricom (1999) noted the depleted status of pinto abalone populations in Washington and the high vulnerability of abalone to reductions by foraging sea otters. They did not think it would be possible for abalone populations to recover in the presence of sea otters.

Sea cucumber. In Washington, sea cucumbers (*Parastichopus californicus*) are found in relatively calm water on sand, mud, or rock bottoms along the outer coast and in the Strait of Juan de Fuca. Sea cucumber commercial fisheries occur in the San Juan Islands and near Port Angeles, both east of the present sea otter range. Minor tribal and non-tribal harvests occur within the recent sea otter range (S. Joner and A. Bradbury, pers. comms). Along northwestern Vancouver Island, sea cucumbers declined in abundance as sea otters reoccupied habitat and were absent where otters had become established (Watson 1993).

In the mid-1980's, sea cucumbers were noted as a minor part of the sea otter diet at Cape Alava and Cape Johnson (Bowlby et al. 1988), but still coexisted in significant numbers with otters (Kvitek et al. 1989). Sea cucumbers are generally considered poor quality prey for sea otters. In Gerber and VanBlaricom’s (1999) evaluation of otter-fishery interactions, they were not able to predict the effects of sea otters on sea cucumber fisheries due to a lack of data on the importance of sea cucumbers in sea otter diet, and on the life history and harvest sustainability of sea cucumbers in Washington.

Harvest of sea cucumbers was relatively unimportant in Washington through 1987, with annual harvests typically below 400,000 pounds (Hoines 1996). In 1988, harvest for the export market increased dramatically. Between 1988 and 1992 harvests averaged 3 million pounds annually and were valued at a yearly average of about $2.5 million (Hoines 1996).

Geoducks. In Washington, geoducks (*Panopea abrupta*) are found in Puget Sound and the Strait of Juan de Fuca. At present, the sea otter range does not include areas where geoducks are commercially exploited, although small commercial beds exist in the western Strait.

Sea otters are able to prey upon geoducks (R. G. Kvitek, pers. comm. cited in Riedman and Estes 1990), but their foraging efficiency is poor because adult geoducks bury up to 1 m deep (Kvitek and Oliver 1989). For this reason, Carter and VanBlaricom (1998) believed that geoducks along the Strait of Juan de Fuca would not be significantly impacted by potential sea otter expansion.

The geoduck supports the most valuable clam fishery on the west coast of the United States. Geoduck harvest in Washington averaged over 3 million pounds annually between 1988 and 1992, with a value of $3.4 million per year (Hoines 1996).

Other bivalves. Several clam species of recreational, tribal, or commercial importance are found in Washington, primarily in protected bays. Hardshell clams include Manila, littleneck, butter, cockle, and horse, with only the first two of these being broadly sought by commercial clammers. Although sea otters are found in areas supporting clams, they are not known to significantly affect harvests in Washington.

Where sea otters prey on butter clams off Kodiak Island, Alaska, the clam population is reduced both in abundance and in mean size (Kvitek et al. 1992). Sea otters have affected the Pismo clam fishery in California to such an extent that Wendell et al. (1986:197) pronounced, "Once sea otters are established on clam-bearing beaches, any future stocks of clams will be fully utilized by sea otters, preventing the return of a fishery."

Hardshell clam harvest in Washington averaged over 5 million pounds annually between 1988 and 1992, with a value above $7.1 million (Hoines 1996). Mussels represented 288,000 pounds valued at $330,000 annually.

Fin fish. Fin fish are rarely an important component of sea otter diets, probably because they are more mobile than the sedentary invertebrates usually eaten by sea otters. Thus, it is unlikely that otters will stress fin fish populations or conflict with important fisheries. On the other hand, it is possible that sea otters will benefit fin fish populations in cases where the otters cause indirect enhancement of kelp forests. Kelp adds structural complexity to the nearshore environment, providing shelter and nursery habitat for fin fish. Areas with kelp support more fish and greater species diversity than similar areas without kelp (Simenstad et al. 1978, Bodkin 1988, Laur et al. 1988). Rockfish especially favor kelp forests (Bodkin 1988, Laur et al. 1988).

When kelp breaks free and becomes a drifting algal mass, it becomes habitat for pelagic species, expanding the sea otters' potential sphere of influence. Fish found in drifting algal masses off coastal Washington include rockfish, sablefish, salmonids, sand lance, and lingcod (R. Buckley, pers. comm.).

FACTORS AFFECTING CONTINUED EXISTENCE

Oil Spills

Sources. Within the Washington sea otter range, oil pollution could result from vessel sinkings, collisions, and groundings, as well as unlawful discharges of oily bilge waste. No natural seeps are known from the outer continental shelf off Washington (Strickland and Chasan 1989). Four oil spills have occurred in Washington since 1972 that illustrate the susceptibility of sea otter habitat to oiling. In January 1972, the unmanned troopship *General M.C. Meigs* broke loose from its tow and grounded at Portage Head, releasing 2,200 gallons of Navy Special fuel oil; in December 1985, the tanker *ARCO Anchorage* ran aground in Port Angeles Harbor, releasing about 239,000 gallons of crude oil; in December 1988, the barge *Nestucca* collided with its tug off Grays Harbor, releasing 239,000 gallons of No.6 fuel oil; and in July 1991, the fishing vessel *Tenyo Maru* was struck by a freighter and sank 25 mi northwest of Cape Flattery, while carrying 354,000 gallons of intermediate fuel oil and 97,800 gallons of diesel fuel. The *Meigs*, *Nestucca*, and *Tenyo Maru* spills affected areas within the current sea otter range. The *Anchorage* spill occurred within a possible expansion area.

No gas and oil development occurs in offshore waters of Washington and none is expected in the foreseeable future. Section 2207 of the Oceans Act of 1992 indefinitely bans oil and gas exploration, development, and production within the boundary of the Olympic Coast National Marine Sanctuary, prohibitions that can be lifted only by an Act of Congress (U.S. Department of Commerce 1993). In addition, the outer continental shelf off Washington has been excluded from lease planning under the current (1997-2002) 5-year plan issued by the Minerals Management Service (1996). Furthermore, a state-level, permanent moratorium on gas and oil exploration and production is in effect for coastal waters within 3 mi (4.8 km) of the Washington shoreline, under the Ocean Resources Management Act (Revised Code of Washington 43.143.010).

Vulnerability. Sea otter susceptibility to oil has been recognized for many years, but the T/V *Exxon Valdez* spill in Prince William Sound in 1989 brought the risk into sharp focus. Public attention was directed toward otters, which figured prominently in media coverage of the event. Batten (1990:35) explained the intense interest:

> As a playful, photogenic, innocent bystander, the sea otter epitomized the role of victim ... cute and frolicsome sea otters suddenly in distress, oiled, frightened, and dying, in a losing battle with the oil.

Protecting sea otters from spilled oil can be difficult or impossible. Even under the best circumstances, protection strategies such as booming, skimming, in-situ burning, and dispersants are likely to have limited success in the open-ocean environment. Pre-emptive capture (the removal of unoiled otters in the path of the oil) is neither practical nor advisable; environmental conditions along the Washington coast would pose significant potential risks to handlers, otters, and other wildlife during pre-emptive capture attempts.

Effects of oil on sea otters.—Oil's effects on otters may be acute (immediate) or chronic (long-term). The most pronounced effect is the fouling of an otter's insulative pelage. Because sea otters rely on clean and well-groomed fur to remain warm, even partial contamination (as little as 30% of the total body surface) easily results in death from hypothermia or pneumonia (Kooyman and Costa 1979, cited in Riedman and Estes 1990). When otters attempt to clean their pelage, they ingest hydrocarbons that can be acutely toxic. Sea otters also can inhale volatile components of freshly-spilled oil, injuring their lungs and other organs (Ralls and Siniff 1990).

Potential chronic effects include pathological damage from sublethal exposure to oil, continued exposure to hydrocarbons persisting in the environment, and changes in prey availability (Ballachey et al. 1994). Concentrations of aliphatic and aromatic hydrocarbons in kidney, liver, and muscle tissues are two to eight times greater in oiled sea otters than in otters unaffected by spills (Mulcahy and Ballachey 1994). Kidney, liver, stomach, and lung damage are likely in oiled sea otters that do not die soon after exposure to oil (Lipscomb et al. 1994).

The 1988 and 1991 oil spills in Washington resulted in little impact to the Washington sea otter population, although thousands of sea birds died in each (Jameson 1998a). While no oiled otters were found off the Washington coast following the 1988 *Nestucca* spill, at least one otter was reported killed as a result at Checleset Bay, Vancouver Island, British Columbia, 440 km north of the spill site (British Columbia Ministry of Environment, Lands and Parks 1993). Following the *Tenyo Maru* spill, a sea otter found dead at Rialto Beach in the Olympic National Park was determined to have died of complications caused by oiling (N. J. Thomas, National Wildlife Health Research Center, Madison, Wisconsin, necropsy report).

Despite low mortality in Washington to date, the entire coastal population is highly vulnerable to future spills. The potential for high mortality was illustrated by the *Exxon Valdez* spill in Prince William Sound, Alaska. Within 6 months following that spill, biologists documented roughly 1,000 sea otter deaths. Mortality estimates varied, ranging from 2,650 (Garrott et al. 1993) to 3,905 (DeGange et al. 1994).

Rescue and rehabilitation.—Following the T/V *Exxon Valdez* oil spill in Prince William Sound, extraordinary efforts were made to rescue and rehabilitate oiled sea otters (Bayha and Kormendy 1990). Those efforts may have had minimal value to the sea otter population in Prince William Sound at that time (Monnett et al. 1990, Estes 1991). However, knowledge gained about spill progression patterns and the effectiveness of various response strategies was substantial, and is important in guiding policies and protocols for future spill events (VanBlaricom, pers. comm.). Strong public sentiment toward sea otters dictates that rescue and rehabilitation be attempted when spilled oil affects otters. A spill rescue protocol has been developed for Washington (U.S. Fish and Wildlife Service 1994) and procedures have been developed for standardized care of oiled otters (White 1998).

Other Contaminants

Polychlorinated biphenyls (PCB's), chlorinated hydrocarbons (DDT and derivatives), and heavy metals have been found in sea otter tissues, but no adverse effects have been documented (Riedman and Estes 1990, Jarman et al. 1996). Reproductive failure often results from PCB contamination of birds and mammals, but birth rates in southern sea otters seem to be unaffected by accumulation of PCB's in liver tissues (Riedman and Estes 1990).

Marine Biotoxins

At least two naturally-occurring toxins cause illness or death in humans that eat shellfish that store them. Their effects on sea otters only recently have been studied, but early results suggest sea otters are able to detect and avoid lethal doses of at least one biotoxin (saxitoxin; Kvitek et al. 1991).

The dinoflagellate *Alexandrium catenella* (previously known as *Gonyaulax catenella* or *Protogonyaulax catenella*) causes Paralytic Shellfish Poisoning (PSP). Crabs and bivalve shellfish (clams, oysters, mussels, and scallops) have the potential to accumulate PSP toxins. For decades, presence of PSP has forced a regulatory closure for human consumption of mussels and clams (except razor clams) in the Strait of Juan de Fuca west of Dungeness Spit, as well as the ocean beaches.

Domoic acid is a natural amino acid found in certain diatoms (*Pseudo-nitzschia spp*.) and a number of other marine algae. Filter-feeding shellfish (razor clams and crabs, for example) can accumulate domoic acid and pass it on to their predators. In October 1998, the highest level of domoic acid ever recorded off the Washington coast (286 ppm) was reported off Kalaloch Beach (NOAA1999). It is unknown what the impact would be if otters expanded their range south and foraged on razor clams during these biotoxin outbreaks. People who eat affected shellfish may suffer from Amnesic Shellfish Poisoning.

Entanglement and Entrapment

Incidental drowning of sea otters can occur when they are entangled in gill or trammel nets (Riedman and Estes 1990). Set-nets have entangled sea otters in Alaska (DeGange and Vacca 1989) and California (Wendell et al. 1985, cited in Kvitek et al. 1989). Net entanglement is believed to have killed an average of 80 sea otters per year in California between the mid 1970's (or earlier) and the early 1980's (Wendell et al. 1985, cited in Riedman and Estes 1990). Restrictions on the use of gill and trammel nets were followed by a resurgence of the sea otter population. California state law (CSB #2563) prohibits the use of gill or trammel nets (essentially, nets with a mesh >3.5 in) in waters shallower than 30 fathoms at mean low water through much of the southern sea otter range (U.S. Fish and Wildlife Service 1996).

In Washington, non-treaty gill nets are prohibited throughout the current sea otter range. One sea otter was taken in a treaty set-net at Spike Rock in 1989 (Kajimura 1990) and two sea otters were caught in control nets during an acoustic alarm experiment off Shi Shi Beach (Gearin et al. 1996). Gerber and VanBlaricom (1999) noted that the potential for incidental take of sea otters in set nets will likely increase as the number and range of sea otters increase.

Sea otters can drown in trap or pot gear used for crabs or cod. Seventeen otters are known to have been taken in various traps and pots used in Alaska and California (Newby 1975, B. Hatfield, pers. comm.). No sea otter deaths have been attributed to pot gear in Washington. Crab pots may be the most likely to capture otters, as many are used near shore. Black cod and shrimp pots are not likely to capture otters because they are generally used in deeper waters, which are beyond the typical dive depths (< 30 m) of sea otters.

Harvest

Sea otters were extirpated in Washington due to intensive commercial harvest for their valuable pelts. When sea otters from Alaska were reintroduced to the state's fauna in 1969 and 1970, the Washington Department of Game (1969:7,1) stressed its disinterest in once again exposing otters to harvest:

> The purpose of reintroducing the sea otter to its former Washington habitat is not to attempt to create a fur industry of economic importance, but to establish once again an unusual and interesting mammal that rightfully deserves a place in Washington's wildlife heritage. ...The State Game Department does not contemplate any future trapping...

Some Indian tribes in Washington, however, have maintained an interest in hunting sea otters. The Makah, S'Klallam, and Quinault tribes are known to have hunted sea otters in the past (Wagner 1933, Scheffer 1940) and the Quileute and Hoh tribes probably did, also. The Makah, in article 4 of the Treaty of Neah Bay, reserved "the right of taking fish and of whaling or sealing." Other tribes reserved "hunting" rights in their treaties. The Marine Mammal Protection Act does not abrogate treaty rights.

Sea otter harvest by coastal Alaskan natives has been authorized since passage of the Marine Mammal Protection Act in 1972. The U.S. Fish and Wildlife Service has maintained records of the harvest since fall 1988. During the ensuing decade, the Service tagged an average of about 625 harvested sea otters each year (W. Stephensen, pers. comm., 1998). About 140 people from 107 Alaskan villages hunt sea otters. The Alaska Sea Otter Commission (ASOC), in cooperation with the Service, has initiated a program in which sea otters taken for subsistence are necropsied by a network of native biosamplers (Alaska Sea Otter Commission 1998).

Habitat Loss

Since their reintroduction in Washington, sea otters have tended to congregate in areas with kelp cover. This association is also characteristic elsewhere. While recent kelp distribution has been relatively stable in Washington (Van Wagenen 1999), declines in kelp canopy could occur in the future. Increased watershed sediment loads have negatively impacted nearshore kelp beds (Devinny and Volse 1978, Dayton et al. 1992, Shaffer and Parks 1994). El Niño events appear to affect *Macrocystis* negatively (Van Wagenen 1999), but research on this topic is in its infancy. Although long-term effects of oil pollution on kelps has not been studied in detail, short-term impacts have been documented (Antrim et al. 1995).

Genetic Diversity

Washington's present-day sea otter population descended from no more than 43 animals, the known survivors of 1969 and 1970 translocations. However, the founder population was likely much smaller. In the early 1970's no more than 10 sea otters were reported seen (Bowlby et al. 1988); and the first systematic survey in 1977 found 19 individuals (Jameson et al. 1986). Any population exposed to evolutionary "bottlenecks" risks being affected by reduced genetic diversity, which is generally presumed to impart deleterious effects (Ralls et al. 1983). Loss of diversity should be minor, however, if the "bottleneck" is relatively short and the population is sufficiently large. When considering the case of southern sea otters, Ralls et al. (1983) concluded the population theoretically retained a large proportion of its genetic diversity, despite having numbered as few as 50 individuals in 1914. Tests on mitochondrial-DNA sequences (Cronin et al. 1996) and electrophoretic variation (Lidicker 1997) support their conclusion. Tests on the mitochondrial DNA of Washington's translocated otters indicate a haplotype diversity loss of 16% relative to the source population at Amchitka Island (Bodkin et al. 1999). This reduction is not believed to be problematic (J. Bodkin, pers. comm.). Should Washington sea otters remain isolated from other populations and become impacted by any catastrophic decline in abundance, the population could experience further erosion of genetic diversity. On the other hand, interchange with British Columbia sea otters is possible, which could allow gene flow with a genetically-diverse population (Bodkin et al. 1999).

Disturbance

Direct and indirect effects of human activities on sea otters have not been well studied. Sea otters in some areas of Alaska and California frequent human environments and appear to have habituated to human activities. However, sea otters can be sensitive to human disturbance and are frequently described as being "shy." The Washington sea otter population is geographically remote, so it has had little opportunity to habituate to humans. Researchers attempting to capture sea otters off the Washington coast find them to be wary of approach from the water. The effects of shore-based viewing of sea otters should be less pronounced.

Other Factors

Sea otters are also subject to shooting, boat collisions, and propeller lacerations. Occasional deaths may be associated with research activities and captures for display (Riedman and Estes 1990). None of these factors are known to be of concern in Washington at this time.

CONCLUSIONS

Sea otters thrived off the coast of Washington for thousands of years before they were extirpated by an intensive harvest for their valuable pelts during the 18th and 19th centuries. From about 1911 to 1969, sea otters were absent from the state, but in 1969 and 1970, 59 otters were reintroduced to the coast from Amchitka Island, Alaska. After a decade of uncertain status, the Washington sea otter population began to grow steadily. The most recent survey, in July 1999, found 605 individuals**.** Since 1989, the population has grown at an average annual rate of about 11%.

The recent sea otter range in Washington has extended from Destruction Island to Neah Bay, with concentrations in the vicinities of Destruction Island, Cape Johnson, Sand Point, Cape Alava, and Makah Bay. The current distribution differs from the pre-exploitation range, which extended south to the Columbia River with a major concentration off Point Grenville.

Sea otters are predators of benthic invertebrates, consuming many pounds of prey each day to meet their high metabolic needs. Through their predation on herbivorous sea urchins, they may, in some circumstances, indirectly enhance the growth of kelp and kelp-associated communities.

The growth and restoration of the sea otter population raises major management issues. Sea otters consume shellfish species—urchins, abalones, clams, crabs—important to commercial, recreational, and tribal fisheries. They are vulnerable to oil spills. They may eventually be harvested by tribes with treaty rights. These issues and others, combined with the species' popular appeal, will complicate management and recovery of sea otters in Washington, as they have in Alaska and California.

Part Two of this recovery plan describes strategies and tasks that are intended to assure the long-term existence of sea otters in Washington.

PART TWO: RECOVERY

RECOVERY GOALS

The goals of the sea otter recovery program are:

1) To implement strategies meant to assure a self-sustaining sea otter population in Washington through the foreseeable future (i.e., 50 to 100 years; Estes et al. 1996);
2) To manage the Washington sea otter stock in a manner consistent with the Marine Mammal Protection Act, state and federal laws, and court rulings.

RECOVERY OBJECTIVES

The sea otter will be considered for downlisting from State Endangered to State Threatened status when the following three objectives are met:

1) A population of at least 500 sea otters has existed in Washington for at least 5 consecutive years;
2) The sea otter population is distributed such that a single catastrophic event, such as a major oil spill, would be unlikely to cause its extirpation; and
3) Management plans or agreements are in place by the state's sea otter co-managers that provide for the continued viability of the sea otter in Washington.

The sea otter will be considered for downlisting from State Threatened to State Sensitive status when the following three objectives are met:

1) A population of at least 1,850 sea otters has existed in Washington for 5 consecutive years;
2) The Washington sea otter population is distributed such that a single catastrophic event, such as a major oil spill, would be unlikely to cause its extirpation; and
3) Management plans or agreements are in place by the state's sea otter co-managers that provide for the continued viability of the sea otter in Washington.

Rationale

Recovery Goals. The Washington Department of Fish and Wildlife bears a responsibility to preserve, protect, and perpetuate Washington's wildlife (RCW 77.12.010). However, state laws and regulations pertaining to the Washington sea otter stock are superseded by the federal Marine Mammal Protection Act (MMPA; Section 109, 16 USC 1379). Accordingly, management of Washington's sea otter stock is guided in part by MMPA regulations.

Recovery Objective #1. The ideal size of Washington's sea otter population theoretically is equivalent to the stock's Optimum Sustainable Population (OSP) size as determined under the MMPA. OSP is defined as, "the number of animals that will result in the maximum productivity of the population, keeping in mind the carrying capacity [K] of the habitat and health of the ecosystem" (16 USC 1362, Section 3, paragraph 9). In practice "the lower end of the OSP range is assumed to occur at approximately 60% of... K" (DeMaster et al. 1996:79). As of June 2000, the U.S. Fish and Wildlife Service, which is responsible for implementing the MMPA as it relates to sea otters, had not determined an OSP level or a carrying capacity (K) for the Washington sea otter stock (USFWS 1997; R. Jameson, pers. comm.). However, work was begun in May 2000 to determine a carrying capacity for sea otters in Washington (R. Jameson, pers. comm.). An accurate estimate of the carrying capacity for the Washington sea otter will assist the U.S. Fish and Wildlife Service in reliably determining the OSP for sea otters in Washington.

Carrying capacity is difficult to estimate, as its calculation requires information that is typically unavailable (DeMaster et al. 1996). One approach to calculating K involves extrapolating sea otter density to the amount of available habitat. James Dobbins Associates (1984), estimated that the carrying capacity for sea otters in Washington between Destruction Island and Observatory Point (west of Port Angeles) would be 1,280 to 2,560 sea otters. The range was derived from estimates of the area with rocky substrate (414 km^2) and the total area within the 20-fathom isobath (829 km^2). In their calculations, they used a density of 3.1 otters/km^2, based on an average of sea otter densities in rocky- and sandy-bottom habitats in California. Using a more recent weighted average density estimate from California of 5.9 otters/nm^2 (DeMaster et al. 1996) results in a slightly lower carrying capacity estimate of 1,251 to 2,502 sea otters (R. Jameson, pers. comm.).

Densities with respect to habitat have not yet been estimated in Washington, in part because sea otter abundance is not reliably constant anywhere in the state—numbers in the South segment (Destruction Island to James Island) continue to grow, while numbers in the Central segment (James Island to Cape Alava) tend to be inflated during the annual survey (R. Jameson, pers. comm.). An estimate of carrying capacity is also hampered by a lack of habitat data. Substrate data, for example the amount of rocky, sandy, and mixed substrate habitat, have not yet been delineated and measured for Washington, although seafloor mapping surveys are scheduled to begin in the summer of 2000 (E. Bowlby, per. comm.). Another complication is that carrying capacity for sea otters likely fluctuates with changes in habitat such as kelp distribution and abundance. These issues are being addressed in ongoing work by R. Jameson, K. Laidre, and E. Bowlby to estimate the sea otter carrying capacity for Washington (R. Jameson, pers. comm.)

In the absence of verifiable estimates for OSP and K, the Department has set preliminary objectives for population recovery. The Department believes that the sea otter population will cease to meet the definition of State Endangered before reaching the low end of its

OSP range. The provisional downlisting (endangered to threatened) objective is set at a level (i.e., 500 otters) where, combined with the distribution and cooperative management objectives, the species will not be "seriously threatened with extinction throughout all or a significant portion of its range within the state" (WAC 232-12-297).

The Department's population objective for downlisting from threatened to sensitive is derived from research on sea otter population viability. Ralls et al. (1996) built upon a foundation laid by Franklin (1980), Frankel and Soulé (1981), Ralls et al. (1983), and Mace and Lande (1991), to calculate a minimum viable population level for the southern sea otter. Their estimated minimum viable population of 1,850 animals was based on sea otter life history traits and conservation biology principles, and is also appropriate for the Washington stock. An actual population (N) of 1,850 represents a genetically-effective population (N_e) of 500. A population of this size should possess short-term adaptability and long-term evolutionary potential.

During the immediate future, the Department anticipates the sea otter population in Washington will remain isolated from sea otters in British Columbia and California. Therefore, recovery objectives should be independent, during the near term, of otter immigration from outside the state. If interchange should occur between the Washington population and another sea otter population, these recovery objectives may need to be reassessed. For example, if sea otters from Washington and British Columbia begin to interbreed, the Washington component would no longer need to be managed specifically for genetic viability.

Objective #2. If the range of Washington's sea otters is restricted, the entire population could be impacted by a single oil spill or other catastrophic event. To prevent a severe decline (or extirpation), the population should be distributed so that a sustainable subpopulation of otters would remain unaffected by such an event. The Department considers a distribution from Destruction Island to Tatoosh Island to be too restricted to meet the intent of this recovery objective. Because the potential sea otter range cannot be predicted, this objective must be assessed when objectives #1 and #3 have been met.

Objective #3. Cooperation is essential to the conservation of Washington's sea otter population. Agreements among state, federal, and tribal entities are needed to provide a degree of certainty that co-managers will strive together to recover and maintain a self-sustaining population of sea otters in Washington.

RECOVERY STRATEGIES AND TASKS

1. Monitor the Washington sea otter population.

1.1. Conduct annual surveys of sea otter abundance and distribution.

Shore-based surveys are probably the most accurate method for estimating sea otter abundance, but their usefulness is limited due to inadequate access to suitable viewing sites throughout the otter range. To complement ground-based observations, surveys should be completed from fixed-wing aircraft.

The entire outer coast from Point Grenville to Clallam Bay should be surveyed from the air during a brief span in July. The search area should extend from the shoreline to at least the 20-fathom (36-m; 120-ft) isobath. The aircraft should travel at approximately 100 knots at an altitude of 300 to 500 ft. Two surveys per day should be completed over a period of three days (thus, six surveys of entire range, if conditions are favorable).

Surveys totals should be calculated by summing the highest daily count for southern (Point Grenville to La Push) and northern (La Push to easternmost extent) segments of the survey area.

Ground stations should also be occupied. Shore-based surveyors can supplement aerial observations and provide a measure of sighting probability. Ground counting is also the only reliable method for surveying pups, which are difficult to count from the air.

Observers should make periodic explorations beyond the survey area described above, in order to readily detect distribution shifts. The survey effort should adapt as needed to account for range changes.

Responsibility: USGS, WDFW, USFWS, OCNMS
WDFW Involvement: Marine Mammal Investigations, Wildlife Diversity
Estimated annual cost/WDFW share: $8,000/$3,000

1.2. Conduct seasonal surveys of sea otter abundance and distribution.

To refine our understanding of seasonal distribution, intensive surveys should be completed more frequently than once per year. Methods should be similar to those used during annual surveys, but may need to be modified to account for changing survey conditions throughout the year.

Responsibility: WDFW, USGS, OCNMS, USFWS
WDFW Involvement: Marine Mammal Investigations
Estimated annual cost/WDFW share: $5-8,000/survey

2. Protect the sea otter population.

2.1. Prepare for the care and treatment of oiled sea otters.

A spill rescue protocol has been developed for Washington (U.S. Fish and Wildlife Service 1994). If oil spills threaten sea otter habitats, no pre-emptive measures (i.e., captures of unoiled otters) are planned. Response will be directed toward oiled sea otters only, whose capture will be directed by the U.S. Fish and Wildlife Service or its designee(s) (WDFW is among designees). Before any sea otter is captured, rescuers will ascertain that the otter is actually oiled and can be safely captured. Dip nets or Wilson nets will be used for capture (tangle nets are not practical for use in most habitats occupied by Washington otters).

Procedures for standardized care of soiled otters have been developed by an oil spill task force (White 1998). The care standards address capture and transport protocols, rehabilitation protocols, housing requirements, record-keeping techniques, health and safety recommendations, and training requirements for staff supervisors and animal care volunteers. Additional information on sea otter rescue following oil spills is presented by Bayha and Kormendy (1990), the U.S. Fish and Wildlife Service (1994) and Williams and Davis (1995).

To maintain sea otters in captivity requires a large quantity of clean, cool sea water and an adequate food supply. Food representing about 20% of an otter's weight has been estimated to cost $10,000 to $14,000/otter annually (Brennan and Houck 1996). The Department and the U. S. Fish and Wildlife Service are evaluating and considering the costs and benefits of sending oiled otters to a treatment facility elsewhere, as opposed to treating oiled otters in state. Because sea otters experience significant stress when being moved from one location to another, the cost/benefit analysis must include an assessment of the increased mortality and pathology that would accompany shipment of oiled otters out of state for treatment.

Responsibility: USFWS, WDFW, OCNMS, Oil Spill Responsible Party
WDFW Involvement: Spill Response Team, Marine Mammal Investigations
Estimated annual cost/WDFW share: To Be Determined (TBD)

2.2. Prevent sea otter deaths caused by fishing gear.

Sea otters can die when entangled in nets or caught in traps, but little information is available on the extent of incidental take in Washington. Co-managers should document otter deaths in fishing gear to determine types of equipment involved, frequency of interactions, and susceptible elements of the sea otter population. Strategies should then be developed to minimize mortality.

Responsibility: USFWS, NMFS, WDFW, OCNMS, Tribes
WDFW Involvement: Marine Mammal Investigations, Marine Resources, Resource Assessement
Estimated annual cost/WDFW share: TBD

3. Protect habitats used by sea otters.

3.1. Prevent oil spills that could affect areas frequented by sea otters.

The Olympic Coast National Marine Sanctuary has identified an Area To Be Avoided (ATBA) by vessels transporting petroleum or other hazardous materials using the northern coast. Compliance is not mandatory, but should be encouraged. The ongoing Olympic Coast National Marine Sanctuary assessment of ATBA effectiveness (Galasso 2000) should be continued and additional areas should be considered for delineation.

Responsibility: OCNMS, USFWS, WDFW, USCG
WDFW Involvement: Marine Mammal Investigations, Spill Response Team
Estimated annual cost/WDFW share: TBD

3.2. Respond to oil spills to minimize their effects on sea otter habitats.

Whenever feasible, shorelines and waters used by sea otters should be protected from pollution by spilled oil. Portions of the Washington coast are provisionally approved for in-situ burning, a method to remove oil from the water's surface through controlled ignition and burning. Also, chemical dispersants can be used in certain offshore areas on the outer coast. A workshop was held in June 2000 on "Assessing the Risks Associated with Oil Spills and Dispersants" as part of the Washington Ecological Risk Assessment Process.

Responsibility: USFWS, USCG, WDFW, OCNMS, Oil Spill Responsible Party
WDFW Involvement: Spill Response Team, Marine Mammal Investigations
Estimated annual cost/WDFW share: TBD

4. Enforce regulations designed to protect sea otters.

4.1. Minimize "take" of sea otters in Washington.

WDFW should encourage the U.S. Fish and Wildlife Service to lead an active enforcement program that ensures adequate protection of Washington sea otters.

Responsibility: USFWS, WDFW, OCNMS
WDFW Involvement: Enforcement
Estimated annual cost/WDFW share: TBD

5. Establish information management and retrieval systems.

5.1. Centralize data collected during Washington sea otter surveys.

Maintaining a centralized data base for results from Washington sea otter surveys will ensure accurate and consistent information is shared with sea otter co-managers and the general public. WDFW headquarters should maintain copies of data collected during surveys.

Responsibility: USGS, WDFW, OCNMS
WDFW Involvement: Marine Mammal Investigations, Wildlife Resource Data System
Estimated annual cost/WDFW share: $2,000/1,500

6. Develop public information and education programs.

6.1. Implement a proactive information dissemination program for use during oil spills.

Human activity in response to oil spills is intense, and an uncoordinated information system can exacerbate confusion. Pooled media coverage, employing a partnership between agency public information specialists and a sea otter biologist (as needed), will ensure consistent presentation of spill details as they relate to sea otter effects and rehabilitation efforts.

6.11. <u>Ensure availability of information</u>

Ensure that information on sea otters in Washington and on rescue and rehabilitation protocols are readily available to be shared with the public and the media in the event of an oil spill.

Responsibility: USFWS, WDFW, OCNMS
WDFW Involvement: Spill Response Team, Marine Mammal Investigations, Media Staff
Estimated annual cost/WDFW share: TBD

6.2. Enhance public awareness of sea otter status and threats.

Encourage media attention to the sea otter situation in Washington. Stockpile videography and still photography to provide to media as needed. Issue news releases after annual surveys. Place sea otter information on agency web sites. Make presentations to schools, interest groups, and scientific gatherings. Publish survey and research results promptly in proceedings and technical literature.

Responsibility: WDFW, OCNMS, USGS
WDFW Involvement: Media Staff, Education
Estimated annual cost/WDFW share: TBD

6.3. Identify appropriate safeguards for ecotour activities.

Washington sea otters generally have received only sporadic exposure to human activity. Because they have not habituated to human presence, they may be particularly susceptible to disturbance from any ecotour activities that may develop. Boat- and aircraft-based otter viewing should be discouraged. The Olympic Coast NMS flight prohibitions (below 2000 ft within 1 mile of coastline or refuge island) and Marine Mammal approach guidelines (such as NMFS Whale Watch Guidelines for not flying below 1,000 ft and avoiding boat approaches closer than 100 yards) and USFWS Refuge guidelines (200 year buffer to refuge islands) should be widely publicized and linked to other public outreach campaigns to reduce human impacts on sensitive coastal wildlife (Tenyo Maru Oil Spill Natural Resource Trustees 2000). Guidelines for shore-based otter viewing should be developed, in cooperation with otter co-managers and ecotour operators, to prevent harassment of sea otters.

Responsibility: USFWS, OCNMS, WDFW, NMFS
WDFW Involvement: Marine Mammal Investigations, Watchable Wildlife
Estimated annual cost/WDFW share: TBD

6.4. Complete annual status review for Washington sea otters.

Describe the status of sea otters in Washington and detail management and research undertaken on behalf of the population. Produce an annual status report both as a booklet/fact sheet and as a web-based publication.

Responsibility: WDFW
WDFW Involvement: Wildlife Resource Data Systems, Wildlife Diversity, Education, Marine Mammal Investigations
Estimated annual cost/WDFW share: $3,000/$3,000

7. Undertake investigations that will facilitate and enhance recovery efforts.

Research is essential to future management of sea otters in Washington and may direct revisions to this recovery plan. The following tasks are expected to have the greatest potential to specifically address immediate issues relating to near-term recovery and management of Washington's sea otters. Broad participation and cooperation will be required. No cost estimates are available for most of these projects.

7.1. Refine estimate of carrying capacity for Washington sea otter habitat.

Recovery criteria are based, in part, upon density data from California, and a rough assessment of suitable sea otter habitat in Washington. An improved estimate of carrying capacity is currently being made (R. Jameson, pers. comm.). The recovery plan will be updated to include that information as soon as it is available, and recovery criteria will be re-evaluated, if warranted.

Responsibility: USGS, USFWS, OCNMS
Estimated annual cost: $13,000

7.2. Determine the extent of interchange between Washington and British Columbia sea otter populations.

Genetic diversity has been considered when specifying the recovery criteria for population size. The rationale associated with these criteria assumes Washington otters are isolated from the British Columbia population. This assumption should be tested. If interchange occurs between these populations, recovery criteria may need to be re-evaluated.

7.3. Assess alternate methods for estimating the status of the Washington sea otter population.

Biologists attempting to determine the status of sea otter populations in relation to an equilibrium level have used a variety of physiological parameters (e.g., growth rates, serum chemistry and hematology) and behavioral parameters (e.g., time activity budgets, food habits). Bodkin and Ballachey (1996) summarized these techniques and described their use on sea otters. Using some alternate assessment techniques could allow refinement of recovery objectives.

7.4. Determine abundance, distribution, and quality of food resources available to sea otters in current and potential habitats.

Prey availability will affect sea otter population growth and range expansion. Determining carrying capacity will likely require information on food resources in the current and potential range of Washington's sea otters. This may influence recommendations for revising the recovery criterion for population size.

7.5. Inventory kelp distribution.

The Washington Department of Natural Resources (DNR) is responsible for managing the state's kelp resources and the Olympic Coast National Marine Sanctuary has identified kelp as an integral component of the nearshore ecosystem. WDFW should encourage the DNR and the Marine Sanctuary to continue a kelp inventory in order to monitor long-term, statewide trends in macroalgae distribution. Available data should be reviewed to determine their usefulness to sea otter management efforts.

7.6. Estimate survival rates from birth to weaning, from weaning to age 1 or 2, and during adulthood (U.S. Fish and Wildlife Service 1996:26).

Determining a minimum viable population (MVP) size requires data on juvenile and adult survival. Data used to set the recovery criterion for population size are based on research in California. Data specific to the Washington population should be obtained to refine the MVP estimate.

7.7. Search for specimens and genetically characterize the original Washington population.

Sea otters were extirpated in Washington long before investigations into subspecific limits were begun. Morphological work suggests Washington otters were intermediate between those from Alaska and California. Genetic techniques may allow relatedness among extant and extirpated subpopulations to be examined. Knowledge of the genetic structure of the original population could influence whether southern sea otters are introduced into the current population.

8. Coordinate and cooperate with public agencies, landowners, nongovernmental organizations, and funding sources.

8.1. Cooperate with entities involved with sea otter research and monitoring.

The Department should be involved, to the greatest extent possible, with monitoring, management, and research related to Washington's sea otter population. The recovery plan review process has brought participants together to consider long-term management of Washington's sea otter population. These parties may continue to meet to implement recovery, revise strategies, and focus research and monitoring efforts.

Responsibility: USFWS, WDFW, OCNMS, USGS, Tribes
WDFW Involvement: Marine Mammal Investigations, Wildlife Diversity
Estimated annual cost/WDFW share: TBD

8.2. Secure funding to support recovery efforts.

Cooperative projects and grants should be pursued to provide ongoing funding for recovery tasks. Creative avenues for expanding the funding base should be explored. In the event of an oil spill that affects sea otters or their habitat, funding for sea otter recovery efforts should be sought as part of a negotiated spill settlement and restoration plan.

Responsibility: USFWS, WDFW, Tribes, OCNMS
WDFW Involvement: Wildlife Diversity, Marine Mammal Investigations, Spill Response Team, Contracts
Estimated annual cost/WDFW share: TBD

9. Prepare for direct population management (intervention).

9.1. Develop a strategy to reduce otter-fishery conflicts.

Sea otters can be expected to impact important commercial, tribal, or recreational shellfisheries. The Department and co-managers must be prepared to address resource conflicts between sea otters and humans if otters enter sensitive shellfish areas. Cooperative, proactive planning for handling sea otter-resource conflicts should be undertaken by the state's co-managers with responsibility for sea otters and fisheries prior to further sea otter range expansion and fishery impacts (Gerber and VanBlaricom 1999). Development and evaluation of alternative management strategies should include a review of sea otter management experiences in California and Alaska, an assessment of short- and long-term effectiveness, relative permanence of effects, and cost-efficiency. Public sentiment toward management approaches should also be included. Any strategy to address otter-fishery conflicts must be consistent with the Marine Mammal Protection Act.

In the event an otter-fishery conflict arises, co-managers should consider a “do-nothing” strategy to allow otters to recover to viable levels. Allowing otters to exploit prey populations would likely accelerate sea otter population growth and progress toward recovery. An increase in the sea otter population and expansion into new areas may also result in increased diversity of kelp forest ecosystems and associated fish species of commercial value, which can offset some of the negative impacts to fisheries. Those gains, however, would likely be offset by loss or reduction of affected fisheries (Gerber and VanBlaricom 1999). Co-managers could also specify limits of shellfish resource loss, beyond which sea otters would be prevented from continuing depredations.

Several methods have been considered for influencing the distribution and movements of sea otters (Packard 1982). They include capture and relocation, natural and artificial barriers, acoustic repellents, negative conditioning, selective killing, demographic manipulation, habitat improvement, and mariculture enclosures. When attempted in areas such as California, non-lethal techniques to influence distribution of sea otters proved to be ineffective, inefficient and prohibitively costly (R. Jameson, G. VanBlaricom, pers. comms.). Zonal management, where certain coastal habitat blocks were designated “sea otter zones” and others “fishery zones”, has been tried in California. The program did not work as anticipated: otters did not stay in the otter zones, expanded their range into the otter-free zones, and could only be removed from the otter-free-zones using non-lethal means (California Public Law 99-625). It has been recommended that the translocation of otters to the otter zone be declared a failure and that maintenance of the otter-free-zone be discontinued to allow the otters to freely expand their range (USFWS 2000). Development of management strategies in Washington should benefit from and build on the experiences of managers in other areas who have been addressing these issues.

Responsibility: WDFW, Tribes, USFWS, NMFS, OCNMS
WDFW Involvement: Endangered Species Section, Marine Mammal Investigations, Resource Assessment, Marine Resources
Estimated annual cost/WDFW share: TBD

9.2. Prepare for possible sea otter harvests by Indian tribes.

In the future, some Washington tribes may develop and implement sea otter management plans. These would likely be done in cooperation with the U.S. Fish and Wildlife Service. The Department should work with tribes and other co-managers (USFWS, OCNMS) to assure that any proposed harvest or hazing of sea otters will not unduly hinder recovery efforts. The Potential Biological Removal (PBR) calculated by the U.S. Fish and Wildlife Service (1999) may provide guidance to determine: 1) if take would be authorized, and 2) what level of take would be appropriate. The USFWS calculates PBR yearly based on annual population numbers from surveys conducted by the USGS. In 1999, PBR was calculated to be 17 animals.

Responsibility: Tribes, USFWS, WDFW, OCNMS
WDFW Involvement: Intergovernmental Policy, Marine Mammal Investigations, Endangered Species Section
Estimated annual cost/WDFW share: TBD

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IMPLEMENTATION SCHEDULE

The outline of strategies and tasks on the following pages identifies co-managers, WDFW involvement, task priorities, and estimates of annual expenditures. The following conventions are used:

Priority 1	Actions necessary to prevent the extirpation of the species from Washington and to monitor the population.
Priority 2	Actions to prevent a significant decline in species population or habitat quality, or some other significant negative impact short of extirpation.
Priority 3	All other actions necessary to meet recovery objectives.

Acronyms:

OCNMS	NOAA Olympic Coast National Marine Sanctuary
NMFS	NOAA National Marine Fisheries Service
TRIBES	Tribal Councils or Resource Managers
USCG	United States Coast Guard
USFWS	USDI Fish and Wildlife Service
USGS	USGS Biological Resources Division
WDNR	Washington Department of Natural Resources
TBD	To Be Determined

Implementation of Recovery Strategies is contingent upon availability of sufficient funds to undertake Recovery Tasks.

Implementation Schedule for Washington State Recovery Plan for the Sea Otter

Priority	Task	Description	Responsible Party	Annual Costs
1	1.1	Conduct annual surveys of sea otter abundance and distribution.	USGS USFWS WDFW OCNMS	2.0 2.0 3.0 1.0
1	1.2	Conduct seasonal surveys of sea otter abundance and distribution.	WDFW USGS OCNMS USFWS	5.0-8.0/ survey
1	2.1	Prepare for effects of spilled oil on sea otters.	USFWS WDFW OCNMS	TBD
1	3.2	Respond to oil spills to minimize their effects on sea otter habitats.	USFWS USCG WDFW OCNMS	TBD
1	8.2	Secure funding to support recovery efforts.	USFWS WDFW OCNMS TRIBES	TBD
2	2.2	Prevent sea otter deaths caused by fishing gear.	USFWS NMFS WDFW OCNMS TRIBES	TBD
2	3.1	Prevent oil spills that could affect areas frequented by sea otters.	OCNMS USFWS WDFW USCG	TBD
2	4.1	Minimize "take" of sea otters in Washington.	USFWS WDFW OCNMS	TBD
2	7.1	Refine estimate of carrying capacity for Washington sea otter habitat.	USGS USFWS OCNMS WDFW	5.0 2.0 6.0
2	7.2	Determine extent of interchange between Washington and British Columbia sea otter populations.	Multiple*	TBD

Priority	Task	Description	Responsible Party	Annual Costs
2	7.4	Determine abundance, distribution, and quality of food resources available to sea otters in current and potential habitats.	Multiple*	TBD
2	7.5	Inventory kelp distribution.	WDNR OCNMS	TBD
2	8.1	Cooperate with entities involved with sea otter research and monitoring.	USFWS WDFW OCNMS TRIBES USGS	TBD
2	9.1	Develop a strategy to reduce otter-fishery conflicts.	WDFW USFWS TRIBES OCNMS NMFS	TBD
2	9.2	Prepare for harvests by Indian tribes.	TRIBES USFWS WDFW OCNMS	TBD
3	5.1	Centralize data collected during Washington sea otter surveys	USGS WDFW OCNMS	2.0
3	6.1	Implement a proactive information dissemination program for use during oil spills.	USFWS WDFW OCNMS	TBD
3	6.2	Enhance public awareness of sea otter status and threats.	WDFW OCNMS USGS	5.0
3	6.3	Identify appropriate safeguards for sea otter ecotour activities.	USFWS OCNMS WDFW NMFS	TBD
3	6.4	Complete annual status review for Washington sea otters.	WDFW	2.0
3	7.3	Assess alternate methods for estimating population status.	Multiple*	TBD
3	7.6	Estimate survival rates to weaning, to age 1 or 2, and during adulthood.	Multiple*	TBD
3	7.7	Search for specimens and genetically characterize original Washington population.	Multiple*	TBD

* Research will require broad participation and cooperation.

Appendix A. 1977-1999 summer sea otter surveys for 3 segments of the Washington coast, and 1995-2000 winter locations (x) of a group of sea otters in the Strait of Juan de Fuca (Jameson et al. 1986; R. Jameson, USGS Biological Resources Division, unpublished data; Jeffries, pers. comm.).

Segment/Location	1977	1978	1981	1983	1985	1987	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
SOUTH																		
Destruction Island	6	6	3	7	8	6	28	30	23	33	27	48	52	26	80	103	171	
Hoh R/Perkins R						1			1			1	13	13	31	13	85	
Toleak/Strawberry									1	11	2	3		1	2			
Giants Graveyard	4					1	5	3	3	1	13	1	8	7	5		2	
Quillayute Needles																1		
Subtotal	10	6	3	7	8	8	33	1	28	45	42	53	73	47	118	117	258	
CENTRAL																		
James Island								10					2					
S. Cape Johnson						2			12	5				14		13		
Cape Johnson	1		11	9	4	25	8		18	30	41	13	2	7	63	35	15	
Offshore Bluff Pt										21							56	
Sandy Island		5									1	1		1		6	4	
Carroll Island													1					
Jagged Island					9						10	29	12	5	8	1	1	
Cedar Creek						1			14	17	48	11	6	20	11	15	11	
Kayostla Beach						1				36							3	
Offshore Yellow B						3										35		
Yellow B Area						5	47	28	46	45	4	78	55	60	4	15	18	
North Pt						3						5				1		
Sand Pt			1	2	33	22	34	36	34	21	26	34	8	112	48	33	36	
Submarine Rock											15	1	1					
White Rock						2									7		1	
S. Ozette Island				15				12				1	1	2	47			
Ozette/CapeAlava	8	1	21	19	11	13	33	20	56	38	34	19	58	129	120	143	116[a]	
W Bodelteh																	1	
Subtotal	9	6	33	45	57	77	122	107	180	208	184	192	146	336	322	284	275	
NORTH																		
Ozette River						2					1	1	3	1			1	
Duk Pt						12	53	71	2			65	110	3	26	14	43	
Pt of Arches									1				3	2	9	7	16	
Portage Head														1				
Makah Bay								1	65	60	80	48	60	40	18	11	5	
Fuca Pillar																	1	
Tatoosh Island												1			4		5	
Waddah Island															5			
Subtotal						14	53	72	68	60	81	115	176	47	62	32	71	
TOTAL	19	12	36	52	65	99[b]	208	212	276	313	307	360	395	430	502	433	604	
Neah Bay													X	X	X	X	X	
Shipwreck Point																X	X	
W of Pillar Point																		X

[a] In reviewing the data for preparation of this table, a minor addition error was found in the 1999 data for the Cape Alava area, and the total was adjusted down by one from previous reports for the survey (R. Jameson, pers. comm.)

[b] The total for 1987 has been adjusted upward from the total presented previously because of an error in addition in the original data set (R. Jameson, pers. comm.).

Appendix B. Washington Administrative Code 232-12-297. Section 11 addresses Recovery Plans.

WAC 232-12-297 Endangered, threatened, and sensitive wildlife species classification.

PURPOSE

1.1 The purpose of this rule is to identify and classify native wildlife species that have need of protection and/or management to ensure their survival as free-ranging populations in Washington and to define the process by which listing, management, recovery, and delisting of a species can be achieved. These rules are established to ensure that consistent procedures and criteria are followed when classifying wildlife as endangered, or the protected wildlife subcategories threatened or sensitive.

DEFINITIONS

For purposes of this rule, the following definitions apply:

2.1 "Classify" and all derivatives means to list or delist wildlife species to or from endangered, or to or from the protected wildlife subcategories threatened or sensitive.

2.2 "List" and all derivatives means to change the classification status of a wildlife species to endangered, threatened, or sensitive.

2.3 "Delist" and its derivatives means to change the classification of endangered, threatened, or sensitive species to a classification other than endangered, threatened, or sensitive.

2.4 "Endangered" means any wildlife species native to the state of Washington that is seriously threatened with extinction throughout all or a significant portion of its range within the state.

2.5 "Threatened" means any wildlife species native to the state of Washington that is likely to become an endangered species within the forseeable future throughout a significant portion of its range within the state without cooperative management or removal of threats.

2.6 "Sensitive" means any wildlife species native to the state of Washington that is vulnerable or declining and is likely to become endangered or threatened in a significant portion of its range within the state without cooperative management or removal of threats.

2.7 "Species" means any group of animals classified as a species or subspecies as commonly accepted by the scientific community.

2.8 "Native" means any wildlife species naturally occurring in Washington for purposes of breeding, resting, or foraging, excluding introduced species not found historically in this state.

2.9 "Significant portion of its range" means that portion of a species' range likely to be essential to the long term survival of the population in Washington.

LISTING CRITERIA

3.1 The commission shall list a wildlife species as endangered, threatened, or sensitive solely on the basis of the biological status of the species being considered, based on the preponderance of scientific data available, except as noted in section 3.4.

3.2 If a species is listed as endangered or threatened under the federal Endangered Species Act, the agency will recommend to the commission that it be listed as endangered or threatened as specified in section 9.1. If listed, the agency will proceed with development of a recovery plan pursuant to section 11.1.

3.3 Species may be listed as endangered, threatened, or sensitive only when populations are in danger of failing, declining, or are vulnerable, due to factors including but not restricted to limited numbers, disease, predation, exploitation, or habitat loss or change, pursuant to section 7.1.

3.4 Where a species of the class Insecta, based on substantial evidence, is determined to present an unreasonable risk to public health, the commission may make the determination that the species need not be listed as endangered, threatened, or sensitive.

DELISTING CRITERIA

4.1 The commission shall delist a wildlife species from endangered, threatened, or sensitive solely on the basis of the biological status of the species being considered, based on the preponderance of scientific data available.

4.2 A species may be delisted from endangered, threatened, or sensitive only when populations are no longer in danger of failing, declining, are no longer vulnerable, pursuant to section 3.3, or meet recovery plan goals, and when it no longer meets the definitions in sections 2.4, 2.5, or 2.6.

INITIATION OF LISTING PROCESS

5.1 Any one of the following events may initiate the listing process.

5.1.1 The agency determines that a species population may be in danger of failing, declining, or vulnerable, pursuant to section 3.3.

5.1.2 A petition is received at the agency from an interested person. The petition should be addressed to the director. It should set forth specific evidence and scientific data which shows that the species may be failing, declining, or vulnerable, pursuant to section 3.3. Within 60 days, the agency shall either deny the petition, stating the reasons, or initiate the classification process.

5.1.3 An emergency, as defined by the Administrative Procedure Act, chapter 34.05 RCW. The listing of any species previously classified under emergency rule shall be governed by the provisions of this section.

5.1.4 The commission requests the agency review a species of concern.

5.2 Upon initiation of the listing process the agency shall publish a public notice in the Washington Register, and notify those parties who have expressed their interest to the department, announcing the initiation of the classification process and calling for scientific information relevant to the species status report under consideration pursuant to section 7.1.

INITIATION OF DELISTING PROCESS

6.1 Any one of the following events may initiate the delisting process:

6.1.1 The agency determines that a species population may no longer be in danger of failing, declining, or vulnerable, pursuant to section 3.3.

6.1.2 The agency receives a petition from an interested person. The petition should be addressed to the director. It should set forth specific evidence and scientific data which shows that the species may no longer be failing, declining, or vulnerable, pursuant to section 3.3. Within 60 days, the agency shall either deny the petition, stating the reasons, or initiate the delisting process.

6.1.3 The commission requests the agency review a species of concern.

6.2 Upon initiation of the delisting process the agency shall publish a public notice in the Washington Register, and notify those parties who have expressed their interest to the department, announcing the initiation of the delisting process and calling for scientific information relevant to the species status report under consideration pursuant to section 7.1.

SPECIES STATUS REVIEW AND AGENCY RECOMMENDATIONS

7.1 Except in an emergency under 5.1.3 above, prior to making a classification recommendation to the commission, the agency shall prepare a preliminary species status report. The report will include a review of information relevant to the species' status in Washington and address factors affecting its status, including those given under section 3.3. The status report shall be reviewed by the public and scientific community. The status report will include, but not be limited to an analysis of:

7.1.1 Historic, current, and future species population trends.

7.1.2 Natural history, including ecological relationships (e.g., food habits, home range, habitat selection patterns).

7.1.3 Historic and current habitat trends.

7.1.4 Population demographics (e.g., survival and mortality rates, reproductive success) and their relationship to long term sustainability.

7.1.5 Historic and current species management activities.

7.2 Except in an emergency under 5.1.3 above, the agency shall prepare recommendations for species classification, based upon scientific data contained in the status report. Documents shall be prepared to determine the environmental consequences of adopting the recommendations pursuant to requirements of the State Environmental Policy Act (SEPA).

7.3 For the purpose of delisting, the status report will include a review of recovery plan goals.

PUBLIC REVIEW

8.1 Except in an emergency under 5.1.3 above, prior to making a recommendation to the commission, the agency shall provide an opportunity for interested parties to submit new scientific data relevant to the status report, classification recommendation, and any SEPA findings.

8.1.1 The agency shall allow at least 90 days for public comment.

8.1.2 The agency will hold at least one Eastern Washington and one Western Washington public meeting during the public review period.

FINAL RECOMMENDATIONS AND COMMISSION ACTION

9.1 After the close of the public comment period, the agency shall complete a final status report and classification recommendation. SEPA documents will be prepared, as necessary, for the final agency recommendation for classification. The classification recommendation will be presented to the commission for action. The final species status report, agency classification recommendation, and SEPA documents will be made available to the public at least 30 days prior to the commission meeting.

9.2 Notice of the proposed commission action will be published at least 30 days prior to the commission meeting.

PERIODIC SPECIES STATUS REVIEW

10.1 The agency shall conduct a review of each endangered, threatened, or sensitive wildlife species at least every five years after the date of its listing. This review shall include an update of the species status report to determine whether the status of the species warrants its current listing status or deserves reclassification.

10.1.1 The agency shall notify any parties who have expressed their interest to the department of the periodic status review. This notice shall occur at least one year prior to end of the five year period required by section 10.1.

10.2 The status of all delisted species shall be reviewed at least once, five years following the date of delisting.

10.3 The department shall evaluate the necessity of changing the classification of the species being reviewed. The agency shall report its findings to the commission at a commission meeting. The agency shall notify the public of its findings at least 30 days prior to presenting the findings to the commission.

10.3.1 If the agency determines that new information suggests that classification of a species should be changed from its present state, the agency shall initiate classification procedures provided for in these rules starting with section 5.1.

10.3.2 If the agency determines that conditions have not changed significantly and that the classification of the species should remain unchanged, the agency shall recommend to the commission that the species being reviewed shall retain its present classification status.

10.4 Nothing in these rules shall be construed to automatically delist a species without formal commission action.

RECOVERY AND MANAGEMENT OF LISTED SPECIES

11.1 The agency shall write a recovery plan for species listed as endangered or threatened. The agency will write a management plan for species listed as sensitive. Recovery and management plans shall address the listing criteria described in sections 3.1 and 3.3, and shall include, but are not limited to:

11.1.1 Target population objectives.

11.1.2 Criteria for reclassification.

11.1.3 An implementation plan for reaching population objectives which will promote cooperative management and be sensitive to landowner needs and property rights. The plan will specify resources needed from and impacts to the department, other agencies (including federal, state, and local), tribes, landowners, and other interest groups. The plan shall consider various approaches to meeting recovery objectives including, but not limited to regulation, mitigation, acquisition, incentive, and compensation mechanisms.

11.1.4 Public education needs.

11.1.5 A species monitoring plan, which requires periodic review to allow the incorporation of new information into the status report.

11.2 Preparation of recovery and management plans will be initiated by the agency within one year after the date of listing.

11.2.1 Recovery and management plans for species listed prior to 1990 or during the five years following the adoption of these rules shall be completed within five years after the date of listing or adoption of these rules, whichever comes later. Development of recovery plans for endangered species will receive higher priority than threatened or sensitive species.

11.2.2 Recovery and management plans for species listed after five years following the adoption of these rules shall be completed within three years after the date of listing.

11.2.3 The agency will publish a notice in the Washington Register and notify any parties who have expressed interest to the department interested parties of the initiation of recovery plan development.

11.2.4 If the deadlines defined in sections 11.2.1 and 11.2.2 are not met the department shall notify the public and report the reasons for missing the deadline and the strategy for completing the plan at a commission meeting. The intent of this section is to recognize current department personnel resources are limiting and that development of recovery plans for some of the species may require significant involvement by interests outside of the department, and therefore take longer to complete.

11.3 The agency shall provide an opportunity for interested public to comment on the recovery plan and any SEPA documents.

CLASSIFICATION PROCEDURES REVIEW

12.1 The agency and an ad hoc public group with members representing a broad spectrum of interests, shall meet as needed to accomplish the following:

12.1.1 Monitor the progress of the development of recovery and management plans and status reviews, highlight problems, and make recommendations to the department and other interested parties to improve the effectiveness of these processes.

12.1.2 Review these classification procedures six years after the adoption of these rules and report its findings to the commission.

AUTHORITY

13.1 The commission has the authority to classify wildlife as endangered under RCW 77.12.020. Species classified as endangered are listed under WAC 232-12-014, as amended.

13.2 Threatened and sensitive species shall be classified as subcategories of protected wildlife. The commission has the authority to classify wildlife as protected under RCW 77.12.020. Species classified as protected are listed under WAC 232-12-011, as amended. [Statutory Authority: RCW 77.12.020. 90-11-066 (Order 442), § 232-12-297, filed 5/15/90, effective 6/15/90.]